CTU Global Postdoc Fellowship

Czech Technical University in Prague now offers a new fellowship program, the CTU Global Postdoc Fellowship. This new and attractive two-year fellowship-program offers excellent researchers who have recently completed their PhD the chance to continue their research career at CTU. Fellows receive a two year fellowship and become members of a team led by a mentor.

The fellowship aims at external international scientists who are currently conducting research abroad. Applicants must have completed their PhD within the last seven years (eg. 2016 or later). The fellowship aims at authors (co-authors) of three or more publications in a journal with IF. The mentor has a strong vote in the selection process.

The CTU Global Postdoc Fellowship is open to all topics listed later in this document. Researchers are invited to apply directly to the faculty/institute, see details below.

Applicants are advised to contact mentors for more details.

Applications deadlines are: June 15, 2023 or August 31, 2023 or November 30, 2023. The deadline for submission is indicated for each research topic/position. How to apply.

Shortcuts to topics/positions at faculties and institutes (click Topics/positions)	
Topic #1-x	Topics/positions available at the Faculty of Civil Engineering
Topic #2-x	Topics/positions available at the Faculty of Mechanical Engineering
Topic #3-x	Topics/positions available at the Faculty of Electrical Engineering
Topic #4-x	Topics/positions available at the Faculty of Nuclear Sciences and Physical Engineering
Topic #5-x	
Topic #6-x	Topics/positions available at the Faculty of Transportation Sciences
Topic #7-x	Topics/positions available at the Faculty of Biomedical Engineering
Topic #8-x	Topics/positions available at the Faculty of Information Technology
Topic #9-x	Topics/positions available at the Klokner Institute
Topic #10-x	Topics/positions available at the Masaryk Institute of Advanced Studies
Topic #11-x	Topics/positions available at the Institute of Experimental and Applied Physics
Topic #12-x	Topics/positions available at the Czech Institute of Informatics, Robotics and Cybernetics
Topic #13-x	Topics/positions available at the University Centre of Energy Efficient Buildings

Document version 1.4. Latest version of this document as well as latest information can be found at international.cvut.cz/postdoc

Topics/positions available at the

Faculty of Civil Engineering

Applications should be sent to

E-mail: eliska.blumlova@fsv.cvut.cz

CTU Global Postdoc Fellowship

Research topic #1-1

1 Topic name	Regularized failure models for quasibrittle materials
ERC research field descriptor	15. 1. Aerospace engineering 15.6 Civil engineering 15.17 Materials engineering 15.18 Mechanical engineering 32.7 Condensed matter properties
2 Link to topic / project page	https://mech.fsv.cvut.cz/~milan/postdoc2023.html
3 Short description of the topic	Many regularized formulations for modeling of fracture have been proposed over the past 30 years, including the increasingly popular phase-field models. Most of these techniques are tailored for tension-dominated failure scenarios. Their reliable extension to general models that can predict failure under general conditions and that are applicable not only to brittle but also to quasibrittle materials is still in its infancy. The proposed project will explore the paths to such extensions and address unresolved issues related to calibration and validation of regularized failure models under general triaxial stress states, effects of boundaries including nonconvex ones, structure and evolution of the localized process zone, regularization for plasticity models with non-associated flow rules, physical background of nonlocality, micro-macro scale transitions for interacting defects, etc.
4 Description of the ideal candidate	Holder of a PhD degree in computational mechanics, solid mechanics, structural mechanics, mechanics of materials or a related field, with keen interest in both mathematical and numerical modeling of damage, fracture and failure. Good theoretical background in continuum mechanics, plasticity, fracture and damage mechanics, combined with appropriate programming and visualization skills (C, C++, Python, ParaView, etc.).

Mentor

Milan Jirásek	Civil Engineering	Mechanics	Milan.Jirasek@cvut.cz

Salary: CZK 62 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #1-2

1 Topic name	**Data-driven modelling of engineering materials**
ERC research field descriptor	Materials engineering (15.17)
2 Link to topic / project page	http://mech.fsv.cvut.cz/~anicka/
3 Short description of the topic	The group focuses on application-driven research in computational data-driven methods for material design. The research topic for the post-doc position will be within the areas of optimization and multiscale modeling, both in probabilistic settings, combining data and expert knowledge of underlying physical principles and using and developing digital material representations. The proposed research aims at combining and integrating (a) physics-based and data-driven modeling and simulation, (b) material microstructure generation, reconstruction, and analysis, (c) material informatics, (d) Bayesian statistics and (e) sensitivity and inverse analysis.
4 Description of the ideal candidate	Candidates are expected to hold a PhD in Materials Science, Data Science, Applied Mathematics, or related field. Previous expertise in finite element-based modeling, material modeling, machine learning, material informatics and methods for uncertainty quantification or optimization will be valued. Knowledge of programming and the English language is required.

Mentor

Anna Kučerová	Faculty of Civil Engineering	Dept. of Mechanics	Anna.Kucerova@cvut.cz

Salary: CZK 70 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #1-3

1 Topic name	A Geometry Processing Support for Microstructure Sensitive Computations
ERC research field descriptor	9.10/Programming/88
2 Link to topic / project page	https://drive.google.com/drive/folders/1tT5oiwiUHRnhdG4x6w54BC5hgpuFM7iQ
3 Short description of the topic	Within the project, the vision is (i) to design and implement a unified platform to share real-world material data in the efficient form of Wang tile based compressions, and (ii) to combine the platform with recently developed in-house processing tools and powerful mesh generators. In particular, the project elaborates strategies to compress microstructural information into sets of Wang tiles that are supplemented with tools for discretization of the tiles with finite element meshes that take into account the generalized periodic boundary conditions inherent to the Wang tiling concept. With these procedures at hand, arbitrarily large, random realizations of the processed microstructures, including their conforming discretization, may be assembled at a marginal computational cost. The motto of this scientific proposal is thus “Compress, discretize, share, and benefit.”
4 Description of the ideal candidate	An ideal candidate for this position should optimally have a proven experience (or express enthusiasm) in ● Code development skills, preferably in, C/C++/C#/MS Azure, or an equivalent programming language/environment

Mentor

Jan Novák	Faculty of Civil Engineering	Experimental Centre	novakja@fsv.cvut.cz

Salary: CZK 69 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #1-4

1 Topic name	Topology optimization of pneumatically actuated sensing metamaterials for soft robotics applications
ERC research field descriptor	15.17 Materials engineering; 15.18 Mechanical engineering; 15.6 Civil engineering; 27.6 Computational mathematics
2 Link to topic / project page	Instead of webpage, we provide a list of relevant literature: ● M. Tyburec., M. Doškář, J. Zeman, and M. Kružík (2022), Modular-topology optimization of structures and mechanisms with free material design and clustering. Computer Methods in Applied Mechanics and Engineering (Vol. 395, 114977). http://dx.doi.org/10.1016/j.cma.2022.114977 ● 1963–1981). https://doi.org/10.1007/s00158-021-02957-5 ● Tyburec, M., Zeman, J., Martin Doškář, Martin Kružík, Matěj Lepš (2021). Modular-topology optimization with Wang tilings: an application to truss structures. Structural and Multidisciplinary Optimization (Vol. 63, pp. 1099–1117). https://doi.org/10.1007/s00158-020-02744-8 ● Rokoš, O., Ameen, M.M., Peerlings, R.H.J., Geers, M.G.D.. (2019). Micromorphic computational homogenization for mechanical metamaterials with patterning fluctuation fields. Journal of the Mechanics and Physics of Solids (Vol. 123, pp. 119–137). https://doi.org/10.1016/j.jmps.2018.08.019 ● van Bree, S.E.H.M. , Rokoš, O., Peerlings, R.H.J., Doškář, M., Geers, M.G.D. (2020). A Newton solver for micromorphic computational homogenization enabling multiscale buckling analysis of pattern-transforming metamaterials. Computer Methods in Applied Mechanics and Engineering (Vol. 372, 113333). https://doi.org/10.1016/j.cma.2020.113333 ● Bendsøe, M. P., & Sigmund, O. (2004). *Topology optimization*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-05086-6 ● Liu, C. -H., Chen, L. -J., Chi, J. -C., & Wu, J. -Y. (2022). Topology Optimization Design and Experiment of a Soft Pneumatic Bending Actuator for Grasping Applications. IEEE Robotics and Automation Letters (Vol. 7, pp. 2086–2093) https://doi.org/10.1109/LRA.2022.3142910 ● Caasenbrood, B., Pogromsky, A., & Nijmeijer, H. (2020). A Computational Design Framework for Pressure-driven Soft Robots through Nonlinear Topology Optimization. 3rd IEEE International Conference on Soft Robotics (RoboSoft), New Haven, CT, USA, pp. 633–638 https://doi.org/10.1109/RoboSoft48309.2020.9116010
3 Short description of the topic	Within this project, the candidate will develop topology optimization techniques and tools for rational design of pneumatically actuated microstructures with applications in active mechanical metamaterials, sensing, and soft robotics. The goal will be to design and implement multistable microstructures which can be manipulated into a number of stable states through internally applied pressure. Such (locally stable) configurations need to be designed to yield distinct effective properties, crucial for applications in soft robotics (e.g., adjustable stiffness of end effector for pick and place applications). An important objective in this regard is effective stiffness as a function of the applied pressure, combined with local stability considerations. To allow for sensing, pressure fluctuations triggered by induced deformation at an end effector can be monitored in order to infer applied forces, important for control and feedback loop. The objective of interest in this aspect is maximum sensitivity of the resulting contact force with respect to actuation pressure changes. To achieve the above goals, topology optimization tools will be developed, combining pressure actuation, internal contact, and multi-stability. To address potential issues with tracking of interfaces,

	a level-set based approach will be pursued. The candidate will start with a study of a single periodic unit cell with prescribed target properties, which will be in later stages extended to finite specimens, entire end effectors, or generally grippers. Depending on time available and the interests of the candidate, experimental validation will be considered as well. The project will be conducted in close collaboration with Ondřej Rokoš, an Assistant Professor at the Department of Mechanical Engineering of Eindhoven University of Technology.
4 Description of the ideal candidate	Candidates should have a proven background in some or ideally all the following areas: ● Modeling of elastic materials with large deformations and instabilities, ● Computational mechanics of materials and structures, ● Topology optimization and (computational) homogenization, ● Code development skills, preferably in MATLAB, C++, or a related programming language.

Mentor

Jan Zeman	Faculty of Civil Engineering	Department of Mechanics	jan.zeman@cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #1-5

1 Topic name	Solving structural topology optimization problems by polynomial programming
ERC research field descriptor	27.3 Applied mathematics, 15.6 Civil engineering, 15.18 Mechanical engineering
2 Link to topic / project page	Instead of a webpage, we provide an indicative list of relevant literature: ● M. Tyburec, J. Zeman, M. Kružík, and D. Henrion, Global optimality in minimum compliance topology optimization of frames and shells by moment-sum-of-squares hierarchy, Structural and Multidisciplinary Optimization 64 (2021), 1963–1981, https://doi.org/10.1007/s00158-021-02957-5; http://arxiv.org/abs/2009.12560 ● Tyburec, M., Kočvara, M., & Kružík, M. (2023). *Global weight optimization of frame structures with polynomial programming*. arXiv preprint. https://doi.org/10.48550/arXiv.2211.14066 ● Bendsøe, M. P., & Sigmund, O. (2004). *Topology optimization*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-05086-6 ● Magron, V., & Wang, J. (2023). *Sparse polynomial optimization: Theory and practice*. WORLD SCIENTIFIC (EUROPE). https://doi.org/10.1142/q0382 ● Lasserre, J. B. (2015). An introduction to polynomial and semi-algebraic optimization (1. ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781107447226
3 Short description of the topic	Topology optimization seeks an optimal material distribution for specified boundary conditions while satisfying performance and resource constraints. Although generally non-convex, the feasible set of such problems often follows from an intersection of a finite number of polynomial inequalities. Recent results in mathematical optimization have shown that, in such cases, the moment-sum-of-squares (Lasserre) hierarchy of outer convexifications enables obtaining certified globally-optimal solutions. This project will exploit recent results in polynomial optimization to selected continuum topology optimization problems and investigate the method scalability, problem-specific structure, and convergence guarantees. The candidate will closely collaborate with Dr. Marek Tyburec (CTU in Prague and the Institute of Information Theory and Automation, Czech Academy of Sciences) and with the team formed around an outgoing project No. GA22-15524S awarded by the Czech Science Foundation.
4 Description of the ideal candidate	The candidate should ideally hold a Ph.D. in mathematics or in engineering with a strong mathematical background. The candidate should be able to work individually but also cooperate in a team. The candidate should have a strong publication track record.

Mentor

Jan Zeman	Faculty of Civil Engineering	Department of Mechanics	jan.zeman@cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

CTU Global Postdoc Fellowship

Research topic #1-6

1 Topic name	Soft Surfaces (SOFFA) Constitutive Models, Instabilities and Numerics
ERC research field descriptor	15. 1. Aerospace engineering 15.6 Civil engineering 15.17 Materials engineering 15.18 Mechanical engineering 27.3 Applied mathematics
2 Link to topic / project page	http://mech.fsv.cvut.cz/~mhorak
3 Short description of the topic	In the twenty-first century, we have entered the era of soft materials. Soft materials are omnipresent in nature as well as in emerging fields such as flexible electronics and soft robotics. Interestingly, surface stress can dominate the behavior of soft solids. Many works consider constant and isotropic surface stress in the response of soft material surfaces. However, it has been recently experimentally proven that the behavior of soft surfaces is strain-dependent. The strain dependence of the surface energy brings exciting opportunities as well as challenges. The main goal of this project is to advance the field of soft materials with strain dependent surface energies. The ground-breaking nature of this project lies in the development of (1) a novel, mathematically well founded approach for the description of a strain-dependent surface. Moreover, models with curvature-dependent surface energy, usually neglected for soft solids, are also developed and studied. The second primary objective addresses (2) the modeling of surface instabilities in soft materials with surface energies to open new possibilities for the design of soft materials and devices at small scales by avoiding catastrophic failures and exploiting instabilities to control phenomena such as crack propagation and adhesion. Finally, the developed constitutive models and methods for instability tracking will be integrated into (3) a unique, robust, and scalable open-source simulation tool. The tool will be used to study the effect of strain-dependent surface energy on crack propagation, switchable adhesion, and tunable macroscopic behavior of matrix-inclusion composites with interface stresses.
4 Description of the ideal candidate	The candidate is expected to hold a doctorate (or be very near to its completion) with strong background in at least two of the following areas: • Modeling of elastic materials under large deformations, including modeling of instabilities, • Finite element method and Isogeometric analysis, • Code development skills, preferably in C++, or a related programming language (However, a strong interest in C++ programming is required), • Direct method of calculus of variations in elasticity. The candidate will join a newly established group supported by ERC CZ program aimed at ERC applicants who have succeeded in the evaluation carried out by expert panels of the European Research Council but were not funded under that call due to budgetary constraints

Mentor

Martin Horák	Faculty of Civil Engineering	Department of Mechanics	martin.horak@cvut.cz

Salary: CZK 73 698 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

CTU Global Postdoc Fellowship

Research topic #1-7

1 Topic name	Soft Surfaces (SOFFA) Constitutive Models, Instabilities and Numerics
ERC research field descriptor	15. 1. Aerospace engineering 15.6 Civil engineering 15.17 Materials engineering 15.18 Mechanical engineering 27.3 Applied mathematics
2 Link to topic / project page	http://mech.fsv.cvut.cz/~mhorak
3 Short description of the topic	In the twenty-first century, we have entered the era of soft materials. Soft materials are omnipresent in nature as well as in emerging fields such as flexible electronics and soft robotics. Interestingly, surface stress can dominate the behavior of soft solids. Many works consider constant and isotropic surface stress in the response of soft material surfaces. However, it has been recently experimentally proven that the behavior of soft surfaces is strain-dependent. The strain dependence of the surface energy brings exciting opportunities as well as challenges. The main goal of this project is to advance the field of soft materials with strain dependent surface energies. The ground-breaking nature of this project lies in the development of (1) a novel, mathematically well founded approach for the description of a strain-dependent surface. Moreover, models with curvature-dependent surface energy, usually neglected for soft solids, are also developed and studied. The second primary objective addresses (2) the modeling of surface instabilities in soft materials with surface energies to open new possibilities for the design of soft materials and devices at small scales by avoiding catastrophic failures and exploiting instabilities to control phenomena such as crack propagation and adhesion. Finally, the developed constitutive models and methods for instability tracking will be integrated into (3) a unique, robust, and scalable open-source simulation tool. The tool will be used to study the effect of strain-dependent surface energy on crack propagation, switchable adhesion, and tunable macroscopic behavior of matrix-inclusion composites with interface stresses.
4 Description of the ideal candidate	The candidate is expected to hold a doctorate (or be very near to its completion) with strong background in at least two of the following areas: • Modeling of elastic materials under large deformations, including modeling of instabilities, • Finite element method and Isogeometric analysis, • Code development skills, preferably in C++, or a related programming language (However, a strong interest in C++ programming is required), • Direct method of calculus of variations in elasticity. The candidate will join a newly established group supported by ERC CZ program aimed at ERC applicants who have succeeded in the evaluation carried out by expert panels of the European Research Council but were not funded under that call due to budgetary constraints.

Mentor

Martin Horák	Faculty of Civil Engineering	Department of Mechanics	martin.horak@cvut.cz

Salary: CZK 73 698 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Topics/positions available at the

Faculty of Mechanical Engineering

Applications should be sent to

E-mail: research@fs.cvut.cz

Research topic #2-1

1 Topic name	Surface, interface and coating modification by directed energy deposition (ion or electron beams)
ERC research field descriptor	Solid state physics
2 Link to topic / project page	
3 Short description of the topic	The research topic focuses on theoretical and experimental solutions in the following areas: • Depth distribution of admixture and lattice defects (experiments and Monte Carlo simulation codes). • Modification and growth of crystal structure (experiments and MD and DFT simulations). • Study of ion implantation, ion beam assisted deposition, ion beam mixing. You will be working on the theoretical and experimental development of ion beam modified layers for advanced applications in fuel cells, supercapacitors and biomedical surfaces. Your research will provide insight into the radiation-induced formation of nitrogen-oversaturated structures of metals. This opportunity will allow you to publish high-quality research articles and contribute to the materials design for advanced applications.
4 Description of the ideal candidate	• PhD in physics, materials science, materials engineering or quantum chemistry. • Research experience in the field. • Knowledge of MD and DFT simulation is an added value.

Mentor

František Černý	Faculty of mechanical engineering	Department of physics	Frantisek.Cerny@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #2-2

1 Topic name	Cyber-physical modeling of cultural heritage object degradation for risk-assessment and preventive conservation
ERC research field descriptor	77, 163, 194, 223-227, 240, 346, 363
2 Link to topic / project page	Resources for topic from former projects (with CTU involvement) EU projects: Climate for Culture, PROCRAFT
3 Short description of the topic	Preventive conservation and data driven protection of heritage sites falling in world or national cultural heritage is a societal demand to be addressed. Prerequisite for the data driven protection is monitoring and analyzing the meteorological, environmental and degradation parameters through remote data collection. Particularly, wet/dry cycles (fluctuations), time of wetness and light irradiance are to be evaluated together with the pollution and moisture infiltration into heritage sites like churches, monasteries, castles, museums, monuments or archives. Primarily degradation effects are brought about by airborne pollution deposition and moisture adsorption/absorption onto artifacts' surfaces. Since artifacts are multi-material both metallic and non-metallic the degradation mechanisms are different not only among various alloys but also between wooden and synthetic polymeric materials. The former heritage materials undergo corrosion damage while the latter moisture or (bio)agent-induced damage. All the heritage materials are to be investigated on susceptibility to corrosion and degradation with respect to adverse site conditions and agents. After the sensitivity analysis a modeling of degradation mechanism takes place in the heritage site and allows to propose long-term protection to prevent artifacts' damage cumulation.
4 Description of the ideal candidate	Advance knowledge in computer science (particularly cybernetics and modelling tools) and good knowledge in mechanical engineering (material engineering in particular); additionally knowledge background on surface physics is appreciated

Mentor

Jaromír Fišer	Faculty of Mechanical Engineering	Dept. Instrument. & Control Eng.	jaromir.fiser@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #2-3

1 Topic name	Numerical methods for instrument's design optimization
ERC research field descriptor	15.10 Design engineering 15.21 Precision engineering 32.13 Optics
2 Link to topic / project page	https://control.fs.cvut.cz/cs/projekty/mobilni-mereni-komprese-a-synteza-obrazu-pro-prostorove-promennou-reflektanci-materialu/
3 Short description of the topic	The instruments design is multiparameter problem with infinite number of possible solutions. A new approach for finding design solution of opto-mechanical instruments provides using artificial intelligence. The aim of the topic is to search for possibilities, task formulation and design solution using artificial intelligence. The result will be compared with standard numerical simulation approach in optomechanical instrument´s design.
4 Description of the ideal candidate	knowledge of optical element´s applications knowledge of mechanical design optimization methods experience in scientific work and publication

Mentor

Jan Hošek	FME CTU	Instrumentation and control engineering	Jan.Hosek@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #2-4

1 Topic name	Mixing of multiphase systems
ERC research field descriptor	15.22 Process engineering ,15.18 Mechanical engineering, 15.5 Chemical engineering
2 Link to topic / project page	https://pt.fs.cvut.cz/en/main-2/
3 Short description of the topic	Mixing is a key operation affecting not only the production but also the quality of the product achieved in most production lines of the chemical and food industry. For this reason, it is necessary to pay attention to develop the study of processes taking place in the agitated batch of reactors and bio-reactors with standard and especially non-standard geometrical configuration. The research will focus on the mechanical mixing of multiphase systems, hydraulic mixing, and mixing in apparatuses equipped with static mixers. Special attention will be paid to the agitation of high viscosity batches that exhibit non-Newtonian behavior (viscoplastic and viscoelastic). The research will be based on a theoretical analysis of the transport phenomena (momentum, heat and mass) in agitated batch, supplemented by a wide range of experiments and CFD simulations of these processes. Theoretical and experimental results will be interpreted not only to expand theoretical knowledge about this process, but it will be possible to apply them in industrial production and processing technologies and use them to design unique configurations of industrial equipment to achieve the required technological goals. Within the study of processes in agitated batch, it is possible to focus our interest on the following particular research aims: • Study of hydrodynamics in an agitated batch in equipment with non-standard geometrical configuration. • Mixing of high viscosity and non-Newtonian (viscoplastic, viscoelastic, …) batch in mechanical mixing equipment and in systems with static mixers. • Mixing of heterogeneous and high-concentrated suspensions. • Dispersion of two-phase systems (liquid - liquid, liquid - solid, liquid - gas). • Heat transfer in an agitated batch and between the individual phases. • Mass transfer in an agitated batch. • Study of the kinetics of processes taking place in an agitated batch. • Design of unique configurations of agitated reactors, bioreactors and other mixing equipment, development of new unique types and geometries of mechanical agitators and static mixers. • Scale-up of mixing processes and equipment.
4 Description of the ideal candidate	The candidate should be interested in a CFD analysis of processes, the realization of model and pilot scale experiments, evaluation and interpretation of obtained data.

Mentor

Tomáš Jirout	Faculty of Mechanical Engineering	Department of Process Engineering	Tomas.Jirout@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #2-5

1 Topic name	Exact solutions to the navier-stokes equations for an incompressible flow from the interpretation of the schrödinger wave function
ERC research field descriptor	181: mechanical engineering; 300: applied mathematics
2 Link to topic / project page	http://www.amazon.com/author/vladimirkulish
3 Short description of the topic	The problem, proposed for this study, is among the six unsolved Millennium Problems by the Clay Mathematics Institute. Waves follow our boat as we meander across the lake, and turbulent air currents follow our flight in a modern jet. Mathematicians and physicists believe that an explanation for and the prediction of both the breeze and the turbulence can be found through an understanding of solutions to the Navier-Stokes equations. Although these equations were written down in the 19th Century, our understanding of them remains minimal. The challenge is to make substantial progress toward a mathematical theory, which will unlock the secrets hidden in the Navier-Stokes equations. The existence of the velocity potential is a direct consequence from the derivation of the continuity equation from the Schrödinger equation. This implies that the Cole-Hopf transformation is applicable to the Navier-Stokes equation for an incompressible flow and allows reducing the Navier-Stokes equation to the Einstein-Kolmogorov equation, in which the reaction term depends on the pressure. The solution to the resulting equation, and to the Navier-Stokes equation as well, can then be written in terms of the Green's function of the heat equation and is given in the form of an integral mapping. Such a form of the solution should make bifurcation period doubling possible, i.e. solutions to transition and turbulent flow regimes in spite of the existence of the velocity potential. Hence, the main focus of the proposed research work is to find out a set of conditions, under which the solution is able to describe turbulent flow regime.
4 Description of the ideal candidate	a. PhD or equivalent degree, b. at least ten papers accepted for publication in a journal with relevant Impact Factor, c. the mentor can require additional skills relevant to research field/topic.

Mentor

Vladimir Kulish	Faculty of Mechanical Engineering	Department of Fluid Dynamics & Thermodynamics	Vladimir.Kulish@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #2-6

1 Topic name	Stiffness optimalization of aerospace composite structures in interaction with aerodynamic and mass loading
ERC research field descriptor	15.1 Aerospace engineering, ID164
2 Link to topic / project page	http://mach1.fsik.cvut.cz/postdoc/postdoc1.html
3 Short description of the topic	Design of aerospace structures is characterized by a unique requirement to maximize stiffness with minimal structural weight. These light and compliant structures are loaded mainly by aerodynamic and mass loads, causing deformation of the structure and a change in aerodynamic characteristics. However, this usually negatively perceived phenomenon can be used positively under certain circumstances. If we design such structures from composite materials, the layering of the composite allows us to control the properties of the structure depending on the material and the orientation of the individual layers of the composite. For example, a positive influence on the aerodynamics of the wing depending on the load by the surrounding air stream can be considered. The wing is usually designed from the structural point of view, to reach constant mechanical stress in the load-bearing components. This can lead to changes in its aerodynamical shape with increasing aerodynamic load and to decrease of its performance and overall flight parameters. By optimizing the stiffness of the composite wing structure, it would be possible to achieve optimal shape of the wing, resulting in optimal aerodynamic properties of the wing in the usual range of aircraft operating speeds. By including the aerodynamics of rotating bodies, it would be possible to optimize propeller blades or compressor blades in this way. The research topic would be implemented in successive stages: 1. simple rectangular wing; 2. swept wing; 3. propeller blade; 4. compressor blade.
4 Description of the ideal candidate	The candidate should confidently master the topics: ● Strength of materials ● Mechanics of composite materials ● Aerodynamics The candidate should be also familiar with: ● Aeroelasticity ● Buckling theory ● Optimization procedures ● Composite manufacturing process Regarding the ability to work with specific software, the candidate should be able to use Matlab, Computational Fluid Dynamics (CFD) simulation software, Finite Element Analysis (FEA) simulation software.

Mentor

Tomáš Mareš	Faculty of Mechanical Engineering, Czech Technical University in Prague	Dept. of Mechanics, Biomechanics and Mechatronics	tomas.mares@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #2-7

1 Topic name	Advanced Composites Inspired by Functions in Nature and Biological Structures
ERC research field descriptor	15.18 Mechanical engineering 181
2 Link to topic / project page	http://drone.fsid.cvut.cz/postdoc2023/
3 Short description of the topic	The natural design and coupling of biological structures are the root of realizing the high strength, toughness, and unique functional properties of biomaterials. Advanced architecture design is applied to many materials, including metal materials, inorganic nonmetallic materials, polymer materials, and so on. To improve the performance of advanced materials, the designed architecture can be enhanced by bionics of biological structure, optimization of structural parameters, and coupling of multiple types of structures. The research will be focused on an analysis of the types of structure systems developed by nature and the selection of such types of structures suitable for their creation using new additive and other technologies. The goal is to develop and implement design methods of optimized 3D structures inspired by biological structures so that they meet the required criteria (strength, deformation, thermal conductivity or others) for the specific purposes of their use, e.g. in the light weight design of composite elements or more complexed structures. Specific functional samples of selected structures will be designed, manufactured and tested.
4 Description of the ideal candidate	Ph.D. study focused on mechanics of composite materials, biomaterials and additive manufacturing technologies. Knowledge about structural design, 3D CAD methods and FEM calculations and optimization methods. Experience with experimental testing and strain and stress analysis. on constitutive multiscale material modeling. Ability and enthusiasm to extend it to the suggested multidisciplinary topic.

Mentor

Milan Ruzicka	Faculty of Mechanical Engineering, Czech Technical University in Prague	Dept. of Mechanics, Biomechanics and Mechatronics	milan.ruzicka@fs.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Topics/positions available at the

Faculty of Electrical Engineering

Applications should be sent to

E-mail: drimakat@fel.cvut.cz

or

FEL ČVUT
Zaměstnanecké oddělení
Attn: Ing. Kateřina Dřímalová
Technická 2
166 27 Praha 6
Czech Republic

Research topic #3-1

1 Topic name	Nanocarbon-based electro-chemical biosensors for biomarker detection
ERC research field descriptor	7.1, 7.13, 15.11, 32.3, 32.16, 37.27
2 Link to topic / project page	https://fyzika.fel.cvut.cz/en/applied-physics/
3 Short description of the topic	Monitoring biomarkers is one of the best methods for early cancer diagnosis and treatment. The challenge is to detect biomarkers at low concentration at an early stage and with easily available, affordable and convenient biosensors. Carbon nanomaterials have been reported as highly instrumental for facilitating charge transfer or electrostatic field-effect for enhancing electronic biosensor response down to single base-pair DNA mismatch and analyte fM concentrations. In this project, employing a screen-printed sensor platform will be used for further modification with selected nanocarbon materials and crosslinking with antibody/aptamer based bioreceptors. Covalent and non-covalent configurations as well as various surface chemistries will be prepared and studied with view to charge transport properties, electrolyte interface and electro-chemical biomarker detection. Computer controlled micro-potentiostat will be employed for analyzing sensitivity, selectivity, specificity and LOD parameters as function of sensor composition, microstructure, and biomarker concentration. Gaining an understanding of the mechanisms for biomarkers detection through physical and chemical phenomena will be supported by other microscopic and spectroscopic methods. Computational analyses will also be performed within the research group. In addition to obtaining principle knowledge about the correlation of material, electronic and chemical phenomena in such biosensor we expect to provide technical foundation for making compact high-performance nanocarbon-based electro-chemical biosensors for cancer biomarker detection, in similarity to conventional glucometers.
4 Description of the ideal candidate	Successful candidates must have a PhD in Physics, Chemistry, Materials Science, Bioengineering, Electrical Engineering or closely related disciplines. Prior publication track record in impacted journals with at least 3 papers as the first author is mandatory. A very good knowledge of written and oral English is also mandatory. Good communication skills, initiative and team work are demanded. Prior professional experience abroad from a home country (at least 6 months) is advantageous. EU citizenship or Schengen visa also advantageous.

Mentor

Bohuslav Rezek	FEL	Physics (13102)	rezekboh@fel.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 15 June 2023

Start date: 01 July 2023

Research topic #3-2

1 Topic name	Control Strategies of AC Electric Drives with Emphasis on Efficiency and Reliability Increasing
ERC research field descriptor	15.11 - Electrical engineering
2 Link to topic / project page	-
3 Short description of the topic	The topic focuses on the control of AC electric drives (IM or PMSM) with an emphasis on increasing the efficiency and reliability of operation. The aim is to implement own designed algorithms in a signal processor and simulation environment. The proposed control strategy should pursue the objectives of increasing the efficiency or reliability of the traction drive by means of suitably modified control based e.g.: • on improved mathematical models compensating for parameter variation, • on increasing the drive dynamics and control accuracy, improving the efficiency and reliability, • on maximizing the use of the capabilities of modern signal processors or FPGA circuits in the control of electric drives, • on utilization of SiC or GaN semiconductors in power converter circuit.
4 Description of the ideal candidate	Has to have Ph.D. in electrotechnics, strong background in area of electric drives or power electronics and microprocessor control. Use fluently English, author/co-author paper in journals with IF (Q1/Q2 prefered)

Mentor

Jan Bauer	Faculty of Electrical Engineering	Electric Drives and Traction	bauerja2@fel.cvut.cz

Salary: CZK 80 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #3-3

1 Topic name	Smart Grids and Power System Stability
ERC research field descriptor	15.11, 15.12, 15.27
2 Link to topic / project page	http://k315.feld.cvut.cz/cs/content/enthemes-thesis
3 Short description of the topic	The electric power industry is under pressure to phase out conventional power plants, especially coal, and increase the share of renewables in their energy mix. This trend changes the traditional power system behavior and ways of power system control. With a larger share of renewables, the overall system inertia has decreased. However, the industry has to learn how to operate synchronous generators in a system with a larger share of solar and wind that does not utilize SGs with large inertia. The candidate is expected to develop new power system operation strategies or control strategies using most up to date technologies, e.g.: - Flexible AC transmission system (FACTS) devices - Artificial stability - Smart Flexibility Systems (e.g. H2flex) - Wide Area Systems (WAMS, WACS, WAPS etc.) It is preferred to continue with previous candidate research topic. The research will be supported by experienced group of researchers with close link to the power industry.
4 Description of the ideal candidate	- PhD from Electrical Engineering - Very good publication record - Experience in Power System Simulation (distributed generation, smart grids, power system stability)

Mentor

Zdenek Muller	Fac. of Electrical Engineering	El. Power Engineering	zdenek.muller@fel.cvut.cz

Salary: CZK 75 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #3-4

1 Topic name	Fast algorithms for biomedical imaging
ERC research field descriptor	9.8, 15.4, 27.6, 37.23, PE1_18, PE6_8. PE6_11, PE6_12
2 Link to topic / project page	https://cmp.felk.cvut.cz/~kybic/research.html
3 Short description of the topic	Digital imaging is becoming ubiquitous in medicine and biology. The number of images and their resolution is steadily increasing. Large scale microscopy histology images or 3D+time CT or MRI datasets are just two examples. Hence the need for fast algorithms for performing the basic tasks, namely image registration, segmentation, and classification. In image registration we shall study fast methods based on several principles. For example, registration can be based only on sparsely selected key regions. However, unlike for natural images, we will use 1D or 2D structures instead of pointwise landmarks. Alternatively, registration can be performed jointly with unsupervised segmentation. The structures need to be identified, local motion estimated and aggregated. Global alignment is possible by extracting and matching graphs describing the geometrical structure. For groupwise or sequence registration, the task is to identify a minimal subset of the image pairs to recover the displacement. In image segmentation and classification, we shall study hierarchical approaches, based on the observation that not all parts of the image need to be seen or seen at a full resolution. We shall start with a low-resolution version of the image or randomly selected rectangles and then choose other patches, possibly at a higher resolution, which have the best chance of improving the segmentation and classification, given our computational budget. The topic may be adapted depending on the candidate's interests and abilities.
4 Description of the ideal candidate	PhD in Computer Science, Image Processing or related disciplines not older than 7 years. Good knowledge of programming, image processing and machine learning. Good publication record (several relevant first-author publications in top scientific journals). Good knowledge of written and oral English, initiative and team work ability. Experience abroad and EU citizenship or Schengen visa are an advantage.

Mentor

Jan Kybic	FEL	13133	kybic@fel.cvut.cz

Salary: CZK 70 000 per month

Application deadline: 15 June 2023

Start date: 01 October 2023

Research topic #3-5

1 Topic name	Aerial robot control, trajectory planning, and multi-goal mission planning for agile flight in cluttered environments
ERC research field descriptor	9.5 - Cybernetics, 15.9 - Control engineering
2 Link to topic / project page	http://mrs.felk.cvut.cz/projects/topflight
3 Short description of the topic	The postdoctoral researcher will work on one or more topics related to (a) Aerial Robot Control and/or (b) Trajectory Planning for Aerial Robots and/or (c) Multi-goal path/mission planning. In (a) Aerial robot control the postdoc candidate can develop novel model-based and/or learning-based control methods for agile flight in cluttered environments. In (b) Trajectory planning topic the candidate can work on online/offline trajectory planning algorithms for aerial robots to allow fast flight in environments with obstacles. In (c) Multi-goal mission planning the candidate is expected to do research on the topic of high-level mission planning where the aerial robot has to visit multiple goals in minimum time while subject to battery capacity constraints. The work of the postdoc candidate should enable a reliable and agile deployment of Unmanned Aerial Vehicles in unknown real-world environments with obstacles.
4 Description of the ideal candidate	- A PhD degree in computer engineering, computer science, robotics, or related fields. - Excellent track record (publications in high-IF conferences and journals are strongly required). - Excellent written and spoken English skills. Strong experience with publication activities. - Experience with Aerial Robot Control or Trajectory Planning for Aerial Robots or Multi-goal path/mission planning. - Experience with real UAV systems is an advantage. Passion for robotics, mathematics, programming and abstract thinking is necessary. Ability to develop and implement complex algorithms efficiently. - Experience with ROS, Gazebo, and Git is desirable. - Experience with Machine Learning is an advantage.

Mentor

Robert Pěnička	Faculty of Electrical Engineering	Department of Cybernetics	penicrob@fel.cvut.cz

Salary: CZK 70 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #3-6

1 Topic name	Nonlinear decentralized control with limited computational and communication abilities onboard of UAV swarms.
ERC research field descriptor	9.5 and 15.9
2 Link to topic / project page	http://mrs.felk.cvut.cz/projects/gacr-swarm-ii
3 Short description of the topic	Postdoc position in SWARM ROBOTICS: We seek candidates with swarm and/or multi-robot expertise to help us with our endeavor towards agile swarming of large teams of aerial robots in real-world conditions (such as swarming in caves, forests, urban environment). In particular the following topics will be solved: Nonlinear UAV control for agile flying in real-world conditions. Distributed environment representation for fast feedback control. Agile swarms of aerial robots with reliable multimodal sensing. The researcher will be advising and co-advising a team of PhD and Master students (usually a group of 3-6 students) to support his/her research intention. Besides, a team of HW engineers of MRS group will support the research by maintaining 40+ swarm aerial platforms dedicated to deployment in demanding outdoor environments with obstacles. In this position, continuation in prior research of the postdoc candidate is preferred. The position is proper for researchers that would like to evaluate swarming approaches with real multi-robot systems.
4 Description of the ideal candidate	A PhD degree in computer engineering, computer science, robotics, or related fields - Excellent track record (publications in high-IF conferences and journals are strongly required). - Excellent written and spoken English skills. Strong experience with publication activities. - Experience with real UAV systems or with swarm robotics and swarm intelligence is an advantage - Passion for robotics, mathematics, programming and abstract thinking - Ability to develop and implement complex algorithms efficiently. - Experience with ROS, Gazebo, and Git is desirable.

Mentor

Martin Saska	FEL	Cybernetics	martin.saska@cvut.cz

Salary: CZK 65 000 per month

Application deadline: 15 June 2023

Start date: 01 July 2023

Research topic #3-7

1 Topic name	Ab initio study on photocatalytic activity of van der Waals heterostructures
ERC research field descriptor	32.6, 32.7, 32.16, 32.19, 7.5
2 Link to topic / project page	https://nano.cvut.cz/jobs-opportunities
3 Short description of the topic	Low dimensional materials like layered van der Waals heterostructures are promising photocatalysts thanks to their easily tunable optoelectronic properties. The layer binding occurs thanks to the van der Waals forces, allowing the creation of a wide range of heterostructures which can be tailored to meet the prerequisite of a photocatalyst. However, designing an ideal heterostructure is certainly not a simple task because the chosen materials must fulfill some requirements; among others, an important requirement is that the valence band maximum and conduction band minimum must come from dissimilar elements, and the ideal band alignment is type-II. In this respect, the project goal is to design optimal heterostructures for photocatalysis applications. Ab initio molecular dynamic simulations will be employed to check the thermal stability of selected compounds in operative conditions. Static quantum mechanical calculations will be used to characterize the charge transfer, the electronic structure and the optical activity in terms of the chemical composition and the stacking geometry. The intermediate outcomes will guide the creation of further heterostructures possibly containing dopant species which will enhance the optical activity of the parent materials. The research will be carried out thanks to the access to High Performance Computing (HPC) centers. The results of the project will constitute a guide to design new van der Waals materials for photocatalytic applications.
4 Description of the ideal candidate	Successful candidates must have a PhD in Physics, Chemistry, Materials Science, or closely related disciplines. Experience with ab initio calculations is mandatory. Previous experience on molecular dynamics represents a plus. Researchers are expected to perform calculations on Linux-based HPC centers. Good knowledge of English, both written and oral, is compulsory.

Mentor

Antonio Cammarata	Faculty of Electrical Engineering	Department of Control Engineering	cammaant@fel.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 15 June 2023

Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #3-8

1 Topic name	High Entropy Alloys for nuclear applications
ERC research field descriptor	15.17;15.20
2 Link to topic / project page	https://nano.cvut.cz/jobs-opportunities
3 Short description of the topic	Developing materials that can withstand the harsh conditions of advanced nuclear reactors, including physical, chemical, thermal, and radiation-related challenges, is an urgent matter. High-entropy alloys (HEAs) have emerged as promising candidates due to their exceptional properties and unexplored compositional space. HEAs have demonstrated unique irradiation tolerance, and researchers are exploring potential applications where they may outperform industry-standard materials. A new HEAs with a low neutron cross section will be subject to heavy ion irradiation to mimic neutron irradiation. These alloys can minimize defect production and enhance resistance to irradiation-induced swelling and hardening. The mechanisms underlying this increased tolerance should be investigated. Our research goal is to identify the HEAs with the best mechanical properties and highest radiation tolerance. The successful candidate will conduct material characterization to examine the impact of radiation damage on the mechanical properties of HEAs, including irradiation hardening, defects such as voids, bubbles, dislocations, yield strength, and fracture toughness.
4 Description of the ideal candidate	The ideal candidate for this position should possess the following qualifications: • A Doctorate or Post-Doctorate degree (preferred) in materials science. • Experience in sample preparation using Focused Ion Beam (FIB) technology. • Knowledge of irradiated nuclear materials would be highly advantageous • A proven track record of publications and conference presentations • Experience in collaboration with team members, PhD/Masters students, and guiding their professional development. • Excellent communication skills in English

Mentor

Nabil, Daghbouj	Faculty of Electrical Engineering	Department of Control Engineering	daghbnab@fel.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 15 June 2023

Start date: 01 October 2023

Research topic #3-9

1 Topic name	Advanced control and estimation for cooperative, connected, and automated mobility (ACE for CCAM)
ERC research field descriptor	15.9
2 Link to topic / project page	http://aa4cc.dce.fel.cvut.cz/content/open-positions
3 Short description of the topic	The hosting research group is currently running several research projects aimed at the (broader) goal to contribute to the development of cooperative, connected and automated mobility. Although such research aims at producing academic deliverables such as journal and conference papers, it is conducted in collaboration with industrial partners, hence a strong focus on applicability of the research findings in real life. One of the collaborating companies is a producer of railroad vehicles (trains, trams and metro), the other produces vehicle-to-everything (V2X) communication units tailored to city buses, trolleybuses and trams, hence a strong preference to public transportation in the research. Some research topics explored by the group are vehicle motion state estimation / localization / map-matching by multisensor fusion, braking distance prediction, collision avoidance for trams, energy-efficient train/tram/metro control, desynchronization of departures of vehicles in order to reduce peak loads on the grid, coordination of vehicles passing through signalized intersection, all these exploiting the vehicle-to-everything (V2X) wireless communication. In all these topics, algorithms and data are the key objects for our research, in particular algorithms for control and estimation, possibly (and preferably) augmented with V2X communication. The successful candidate will be invited to join a particular research quest based on their professional experience and preference, but they will also by encouraged to come up with their own ideas (as soon as they learn the possibilities and limitation of the research group and in particular the industrial partners). The interested candidate will also have an opportunity to co-supervise graduate students working in these projects.
4 Description of the ideal candidate	We are seeking a highly motivated postdoctoral researcher with a Ph.D. in control systems and a strong background in mathematical control theory, particularly in optimal/optimization-based control and estimation, including stochastic variants. The ideal candidate will have decent physical modeling and dataset manipulation skills. They should possess a sound engineering mindset with a strong motivation to solve real industrial problems. The successful candidate will have a keen interest in at least one of the following domains: vehicle dynamics and control, intelligent transportation systems, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication. They should be comfortable working in a collaborative research environment and have excellent communication skills. This is equally suitable both as an entry-level and experienced postdoctoral position.

Mentor

Zdeněk Hurák	Faculty of Electrical Engineering	Control Engineering	hurak@fel.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 30 November 2023

Start date: 01 January 2024

Research topic #3-10

1 Topic name	2D materials for 3D sliding applications
ERC research field descriptor	15.17; 32.6; 32.7;32.16;32.19
2 Link to topic / project page	https://nano.cvut.cz/jobs-opportunities
3 Short description of the topic	The core aim is to upscale the superlubricity of 2D materials, so far limited to the nanoscale contacts, to macroscale world, which is relevant to traditional engineering applications. The key goals are the transfer of 2D materials to selected substrates (flat or curved), building a specific station allowing analysis of 2D materials under the load, and tribological testing of various 2D pairs in macroscale contact using a standard pin-on-disc device. These experiments will be supported by nanoscale evaluation of 2D materials friction by Atomic Force Microscopy (AFM). We expect to achieve an extremely low coefficient of friction and no wear in dry sliding; the project is a radical effort to make 2D solid lubricants a viable alternative to liquid lubricants. The project is experimental in nature, but is closely integrated with atomistic simulations performer in our group. The experimental results will be both an input and a verification of simulations, which will then allow the selection of the best sliding pair configuration (2D materials, orientation) and predict the coefficient of friction.
4 Description of the ideal candidate	Successful candidates must have a PhD in Physics, Chemistry, Materials Science, Mechanical Engineering, or closely related disciplines. Good knowledge of English, both written and oral, is compulsory. Essential: Experience with 2D materials and their analysis (structure, mechanical properties), expertise with AFM. Desirable: Previous experience with the assessment of tribological properties, either at nano or macroscale, is welcome.

Mentor

Tomas Polcar	FEL	Control Engineering	polcar@fel.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 15 June 2023

Start date: 01 October 2023

Research topic #3-11

1 Topic name	Novel magnetic sensors for position, speed and electric current
ERC research field descriptor	174
2 Link to topic / project page	https://measure.fel.cvut.cz/index.php/careers
3 Short description of the topic	Magnetic position, speed and electric current sensors are popular for industrial, automotive, aerospace, security, and defense applications. They are cheap, reliable, rugged, and durable and they are resistant to dust and dirt. Their disadvantage is in general low accuracy (with the exception of LVDTs, which reached 0.1 % accuracy), slow response and sensitivity to external magnetic fields. Gradual improvement and optimization of classical magnetic position sensors by engineering development and applied research reached its limit. Only fundamental research can bring a breakthrough. The candidate is expected to develop new design methods and new sensor principles, use novel materials and devices to open the path towards substantially higher precision, speed of response, resistance to external magnetic fields and lower power consumption. He will develop novel semi-analytic methods allowing fast parametric modelling and design of magnetic position sensors and design new types of magnetic position sensors using (b) amorphous and nanocrystalline materials, (c) fluxgate, TMR, and 3-D MEMS Hall sensors
4 Description of the ideal candidate	PhD from Physics or Electrical Engineering strong publication record Experience in FEM simulations, processing of magnetic materials, magnetic measurements and magnetic sensor testing

Mentor

Prof. Pavel Ripka	Fac. of Electrical Engineering	Measurement	ripka@fel.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 15 June 2023

Start date: 01 October 2023

Topics/positions available at the

Faculty of Nuclear Sciences and Physical Engineering

Applications should be sent to

E-mail: lucie.farmackova@fjfi.cvut.cz

Research topic #4-1

1 Topic name	Heavy flavor production in STAR experiment
ERC research field descriptor	365
2 Link to topic / project page	https://www.star.bnl.gov/
3 Short description of the topic	A primary goal of the STAR physics program is to study the properties of the Quark-Gluon Plasma , a novel state of QCD matter consisting of deconfined quarks and gluons. Due to large masses, heavy flavor quarks are produced in initial phases of heavy ion collision. STAR experiment will collect in 2023 largest data sample of data so far that allow for very precise measurement of heavy flavor hadrons. The candidate will employ machine learning techniques to measure production of heavy flavor mesons in these data in order to understand energy loss of heavy quarks in hot and dense nuclear matter.
4 Description of the ideal candidate	Skills in data analysis in high-energy experiments Excellent knowledge of C++ Experiences with application of machine learning techniques in data analysis

Mentor

Doc. Mgr. Jaroslav Bielčík, Ph.D.	FNSPE	Physics	jaroslav.bielcik@fjfi.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #4-2

1 Topic name	Scintillator-based detector development for CBM and ePIC experiments
ERC research field descriptor	37.22 Measurement technology 422 32.0 Physics -other 330
2 Link to topic / project page[7]	https://physics.fjfi.cvut.cz/index.php/en/research2/research-fields https://physics.fjfi.cvut.cz/index.php/en/research2/research-fields?view=article&id=471:hep-lab&catid=21:topics
3 Short description of the topic	The Department of Physics of FNSPE CTU is currently involved in development of detectors for two large experiments. We have a leading role in the design and construction of FSD (forward spectator detector) for the CBM experiment at GSI laboratory as well as in the development of luminosity measurements and electron-tagging instrumentation for ePIC project of the Brookhaven National Laboratory. Both of these detectors are based on a combination of scintillators and silicon photomultipliers (SiPM) technologies. Characterization of material properties and development and testing of detector components are hence of a considerable interest within our detector center. The candidate will work on the design and testing of the scintillator modules and readout and control electronics. He or she will also take part in the design and construction of the FSD detector which should be finished by 2027. Hence substantial part of the detector project will be carried out during the period planned for this position.
4 Description of the ideal candidate	The candidate has a Ph.D. in experimental high-energy physics or related field of study. The candidate is expected to have experience with instrumentation for high-energy physics including proficiency in electronics circuit design and analysis. Proficient in English (spoken and written) is expected. Required programming skills are C++ and Python. Knowledge of ROOT and other HEP tools is of advantage .

Mentor

Jesús Guillermo Contreras Nuño	Faculty of Nuclear Sciences and Physical Engineering	Physics	guillermo.contreras.nuno@fjfi.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 15 June 2023

Start date: 01 July 2023

Research topic #4-3

1 Topic name	Experimental quantum optics and photonics
ERC research field descriptor	32.13 Optics 357 37.32 Quantum technology 432 37.27 Nanotechnology 427 32.16 Solid state physics 360
2 Link to topic / project page	Q3 group homepage
3 Short description of the topic	**The faculty and team**: The Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University is a leading research and education institution in physics, activities covering quantum technologies, high-energy physics, and mathematical physics. It is also the only institution in the region offering a full master's and PhD programs in Quantum Technologies. The research group Q3 at the Department of Physics, led by Prof. Igor Jex, is an active and ambitious team with many international connections both in theory and experiments. It is a pioneering group in the study of quantum optics, networks and its applications, such as the theory and implementation of quantum walks and the formulation of the Gaussian Boson Sampling problem. The group is cooperating with the Nanophotonics group of Prof. Ivan Richter, at the Department of Physical Electronics, with the background and experimental labs of classical and quantum optics, photonics and plasmonics **The subject of the project**: The proposed research will be shared by the two departments of Physics and Physical Electronics, and will deal with the experimental studies of quantum effects in optics, photonics and plasmonics, in combination with the theoretical background. Specifically, the interest will be in performing the pivotal novel quantum optical experiments, using a combination of existing laboratory hardware and own experience, leading towards understanding and utilization of quantum optical effects. Next, the potential extension towards the more complex quantum photonic and / or plasmonics structures will be considered in correlation with possible applications within quantum technologies. **Tasks of the candidate**: The candidate will cooperate with the two groups of the Departments of Physics and Physical Electronics, allowing optimal utilization of the know-how, laboratory equipment and working conditions. The particular direction of the research would be oriented, according to initial studies, his / her background and experimental skills, on both fundamental and advanced quantum optical experiments, with a possible extension towards quantum photonics and plasmonics, seeking for possible applications in the context of quantum technologies and quantum information. The candidate will interact with other team members of both groups on related topics and take part in relevant domestic and international collaborations, in particular, group of prof. Christine Silberhorn Integrated Quantum Optics at the University of Paderborn.
4 Description of the ideal candidate	The fellowship aims primarily at external international scientists who are currently conducting research abroad. Applicants must have completed their PhD within the last seven years (i.e. 2016 or later). The fellowship aims at authors (co-authors) of two or more publications in impacted journals. The mentor has a strong vote in the selection process. The ideal candidate is expected to have a strong background in experimental classical and quantum optics and photonics, and expertise in the experimental generation and processing of entangled photonic states and related experiments. Experience in quantum experiments with optical fibers and more advanced photonic / plasmonic structures, as well as the computer and electronic control of experiments, together with some background in preparation, characterization, and testing of photonic structures will be an advantage.

Mentor

Igor Jex, prof., Ing. DrSc.	Faculty of Nuclear Science and Physical Engineering	Physics + Physical Electronics	igor.jex@fjfi.cvut.cz

Salary: CZK 65 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

Research topic #4-4

1 Topic name	Electrochemistry of Homologues of Superheavy Elements
ERC research field descriptor	7.8 Inorganic chemistry (ID 54) 7.0 Chemistry Other – Nuclear chemistry (ID 63)
2 Link to topic / project page	https://jaderna-chemie.cz/postdoc-2023/
3 Short description of the topic	Exploration of the Super-heavy Elements (SHEs) is one of today's research frontiers that recently drew wide public attention after discoveries of four new elements. Although most chemistry investigations on SHEs use the "easier" gas-phase methodology, many fundamental properties can best be studied in liquid phase. After preliminary test in 2016, a new joint Czech Technical University (CTU) – University of Oslo – Nuclear Physics Institute SHE laboratory was set-up at the U-120M cyclotron beamline in Řež (Czechia) in 2017/2018. The laboratory is equipped with a new Modular Robotic Gas-Jet Target System (MARGE) and a microfluidic liquid-liquid extraction (LLX) system developed at the CTU. The main focus of the new lab is on the chemistry of SHE homologues and on building an on-line versatile fast microfluidic aqueous chemistry apparatus.

	The topic of the proposed post-doctoral research will focus on electrochemistry of the homologues of transfermium actinoids and transactinoids. Main attention will be paid to the study of redox behaviour of Mo and W, as homologues for element Sg (Z=106), Tl and In, as homologues for element Nh (Z=113), and selected lanthanoids as models for the transfermium actinoids Md, No and Lr. The overall aim is to develop a system where the redox behaviour of seaborgium, nihonium and/or transfermium actinoids can be studied by observing the changes in liquid-liquid extraction (LLE) behaviour as a function of reduction potential in an electrochemical cell prior to the extraction stage. This approach is proposed since ordinary electrochemical approaches such as cyclic voltammetry are not available for the single-atom chemistry. Thus, one needs to investigate redox properties of the heaviest elements based on partition behaviour of the single atoms between two phases instead of measurement of electric currents arising from a redox reaction. For these studies a dedicated flow-through electrochemical cell will be developed for the initial stage of the project that should be later miniaturized for application in micro- or minifluidic systems. When applied to the target SHEs, these oxidation-reduction studies are expected to give valuable information on e.g. valence electron states. However, prior to performing very costly and time-consuming studies with the SHEs, the experimental techniques, devices and chemical hypotheses will be tested using SHE homologues that can be produced with smaller accelerators, e.g. the U-120M accelerator in Nuclear Physics Institute ASCR in Rez (NPI Rez) where the laboratory is hosted. Contrary to using long-lived tracers for "off-line" experiments, the small accelerator delivers radionuclides "on-line" identically to how the SHEs will be delivered. The project proposed here will be fundamental for strengthening the established collaboration in Europe for resurrecting research on liquid phase in the field of SHE chemistry and prepare background data for actual experiments in one of the SHE laboratories. *References to CTU publications:* 1. JOHN, J. Chemistry of Superheavy Elements – Test of the Limits of Validity of the Periodic Law. *Chemické listy*. 2019, **113**(4), 205-215. ISSN 0009-2770. 2. BARTL, P., et al. Microfluidic studies of SHE homologues in new facility at NPI REZ. *Czech Chemical Society Symposium Series*. 2018, **16**(2), 268. ISSN 2336-720 3. J.P. Omtvedt, NPI in Rez - New Site for Performing SHE-homologue Experiments. In: *Contributions*. TASCA 17, 16th Workshop on Recoil Separator for Superheavy Element Chemistry, Darmstadt, 2017-09-01. Darmstadt: GSI Darmstadt, 2017. 4. ČUBOVÁ, K., et al. Extraction of thallium and indium isotopes as the homologues nihonium into the ionic liquids. *Journal of Radioanalytical and Nuclear Chemistr* 2018, **318**(3), 2455-2461. ISSN 0236-5731. DOI 10.1007/s10967-018-6270-x. 5. BARTL, P., et al. Fast microfluidic extraction of Sg homologues at new joint CTU, UiO and NPI facility in Rez (CZE). In: *Book of Abstracts*. 6th International Conference on the Chemistry and Physics of the Transactinide Elements, Wilhelmshaven, 2019-08-25/2019-08-30. Darmstadt: GSI Darmstadt, 2019. 6. BARTL, P., et al. Rychlá kapalinová extrakce homologů seaborgia. *Czech Chemica Society Symposium Series*. 2020, **18**(3), 150. ISSN 2336-7202. 7. TERESHATOV, E.E., et al. Valence states of cyclotron-produced thallium. *New Journal of Chemistry*. 2021, **45**(7), 3377-3381. ISSN 1144-0546. DOI 10.1039/d0nj05198e.

CTU Global Postdoc Fellowship

4 Description of the ideal candidate	The ideal candidate must hold a PhD in chemistry. They should have a good background in nuclear and radiochemistry, working knowledge of electrochemistry, and practical hands-on experience from the work in a radiochemical laboratory. Experience with the work at particle accelerators will be an advantage.

Mentor

Jan John	Faculty of Nuclear Science and Physical Engineering	Depart ment of Nuclear Chemistry	john@fjfi.cvut.cz

Salary: CZK 62 000 per month
Application deadline: 30 November 2023
Start date: 01 January 2024

CTU Global Postdoc Fellowship

Research topic #4-5

1 Topic name	Classical and quantum nanophotonics and plasmonics
ERC research field descriptor	32.13 Optics 357 37.27 Nanotechnology 427 37.32 Quantum technology 432 32.16 Solid state physics 360
2 Link to topic / project page	https://www.fjfi.cvut.cz/en/faculty/departments-and-workplaces/department-of-physical-electronics
3 Short description of the topic	Czech Technical University in Prague now offers a new fellowship program, the CTU Global Postdoc Fellowship. This new and attractive two-year fellowship-program offers excellent researchers who have recently completed their PhD the chance to continue their research career at CTU. Fellows receive a two year fellowship and become members of a team led by a mentor. The faculty and team: The Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University is a leading research and education institution in physics, activities covering quantum technologies, high-energy physics, and mathematical physics. It is also the only institution in the region offering a full master's and PhD programs in Quantum Technologies. The research group, led by prof. Ivan Richter, is an active and ambitious team with international connections both in theory and experiments, in the study of classical and quantum nanophotonics and plasmonics and their applications. The subject of the project: The proposed research will deal with the study of classical and quantum effects in nanophotonics and plasmonics nanostructures. Specifically, the interest will be in the detailed analysis, using a combination of approximate and numerical approaches, leading towards understanding of both classical and quantum effects in nanoplasmonics, in terms of material composition as well as exploitation of the quantum effects on the actual surface plasmon-polaritons (SPPs). The potential utilization of both linear and nonlinear effects in future applications will be examined, too, involving e.g. the fields of advanced sensing, surface supported waves, resonant effects, information processing and quantum technologies. Tasks of the candidate: The particular direction of the research would be oriented, according to initial studies and current state of the art, on the fundamental properties of the both classical and quantum interaction between light and SPP at the nanoscale. The implemented simulation tools would appropriately combine, in a complementary manner, the quantum material approaches (quantum hydrodynamic model, TDDFT method) with the conventional models of electrodynamics (FD(E)TD, FMM, BEM, and others).
4 Description of the ideal candidate	The fellowship aims primarily at external international scientists who are currently conducting research abroad. Applicants must have completed their PhD within the last seven years (eg. 2016 or later). The fellowship aims at authors (co-authors) of two or more publications in a journal with IF. The mentor has a strong vote in the selection process. The ideal candidate is expected to have a strong background in photonics, quantum physics, and electromagnetic simulations, with expertise either in plasmonics or metamaterials. Experience in theory of classical and / or quantum nanophotonics, plasmonics, electromagnetic and quantum simulation techniques, in scientific programming, the ability to adapt these techniques to new structural, interaction, and device concepts, together with some experimental experience in preparation, characterization, and testing will be an advantage.

Mentor

Ivan Richter, prof., Ing. Ph.D.	Faculty of Nuclear Science and Physical Engineering	Physical Electronics	ivan.richter@fjfi.cvut.cz

Salary: CZK 63 000 per month
Application deadline: 15 June 2023
Start date: 01 July 2023

CTU Global Postdoc Fellowship

Topics/positions available at the

Faculty of Transportation Sciences

Applications should be sent to

E-mail: knapova@fd.cvut.cz

and copied to

vyzkum@fd.cvut.cz

CTU Global Postdoc Fellowship

Research topic #6-1

1 Topic name	Experiments and modeling of dynamic fracture of materials
ERC research field descriptor	15.17 Materials engineering 15.18 Mechanical engineering
2 Link to topic / project page	http://mech.fd.cvut.cz/vacancies/postdoc-positions
3 Short description of the topic	Dynamic failure and dynamic fracture of materials considering various failure mechanisms, are at the center of our interest. The overall objectives are the development of numerical models based on extensive experimental data from experiments under a broad range of strain rates. The research is aimed at establishing a fundamental understanding of material mechanics of failure at multiscale. We are seeking a highly talented and motivated researcher to work within our impact dynamics group oriented at experimental and numerical investigation of mechanical response of materials and metamaterials at dynamical loading (high-strain-rate experiments using various methods, including SHBP/OHPB, drop tests, other impact loading) using state-of-the-art methods including high speed imaging, DIC, high-speed X-ray imaging (including Flash Xray), etc. The aim of the project is to develop a new constitutive models for Finite Element modelling interesting new (including 3D printed) (meta)materials which would allow for FE simulations of impact under moderate and high strain rates. The approach should include new methods, e.g. physics-based machine learning. The holder of the postdoc position will be a member of a strong research group of young and highly motivated scientists, mainly PhD students and young postdocs.
4 Description of the ideal candidate	The candidate is expected to hold a doctorate (or be very near to its completion) in engineering, materials science, mathematics, physics or a related discipline; or, alternatively, have a good first degree and/or significant relevant industrial experience. Experience with SHPB (Split Hopkinson Pressure Bar) experimental technique for characterization of the behavior of materials at high strain rates and/or evaluation of measured data for constitutive modelling is advantageous, though not required. Aside the constitutive modelling and FE simulations you will be expected to analyze and interpret high strain rate and gas gun experiments. Knowledge in material modelling, data acquisition systems, development of novel diagnostics and apparatuses in experimental mechanics of materials is also beneficial.

Mentor

Ondřej Jiroušek	Faculty of Transportation Sciences	Department of Mechanics and Materials	ondrej.jirousek@cvut.cz

Salary: CZK 62 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #6-2

1 Topic name	Integration of cooperative and automated vehicles into traffic management (Distributed traffic control for cooperative vehicles)
ERC research field descriptor	15.6 Civil engineering 15.9 Control engineering
2 Link to topic / project page	http://lambda.fd.cvut.cz http://maven-its.eu/
3 Short description of the topic	Just the fact, that a vehicle drives by itself does not necessary lead to improvements of traffic conditions in cities. The effect depends on the way, how they are integrated into city management. The existing traffic control algorithms must be changed. The vehicles are part of the algorithms and serve as agents who negotiate with the traffic controllers (another agents) and further with traffic management centres (TMC) to optimise traffic throughput (or other performance indicators) in the road network. The algorithms are based on multiagent framework in order to ensure the distributed nature of the algorithms and include for example negotiation among agents. The distributed intelligence of the solution allows better integration of cooperative and automated vehicles (CAVs) and also contributes to for more robust, distributed algorithms, that adopt to the changes in environment and external disturbances. In the proposed multiagent solution, each cooperative vehicle has several functions. It serves as a source of traffic data (e.g. vehicle position, speed, distance to adjacent vehicles and others.), but at the same time can be addressed as an actuator. There are several use cases that might/shall be used to achieve a network wide optimum, for example: 1. Green Light Optimal Speed Advisory (GLOSA), 2. Green wave for cooperative vehicles, 3. Signal optimisation, or 4. Priority management. The work however includes also optimisation of the information being distributed among the heterogenous agents. Special focus will be on the negotiation among agents. Humans will be always part of the system, either as drivers of conventional or cooperative vehicles, or as pedestrians or bicycle users. They will always need to communicate with the automated vehicles and traffic management algorithms and their travel behaviour shall also be included in the research work. Within this work, the distributed algorithms shall be developed and evaluated using microscopic traffic simulation (preferably SUMO). References: • Pereira, André Maia et al. “Automated vehicles in smart urban environment: A review.” 2017 Smart City Symposium Prague (SCSP) (2017): 1-8. • Pribyl, O, Blokpoel, R., Matowicki, M. Addressing EU climate targets: Reducing CO2 emissions using cooperative and automated vehicles, Transportation Research Part D: Transport and Environment, Volume 86, 2020, 102437, ISSN 1361-9209.
4 Description of the ideal candidate	• University degree • Experience with research work • Ability to fluently communicate in English • Knowledge of traffic control algorithms • Experiences with multi-agent systems • Knowledge of algorithmisation and ability to write computer programs (Java, Python, or others) • Highly cited work

Mentor

Ondřej Přibyl	Faculty of transportation sciences	Applied mathematics	pribylo@fd.cvut.cz

Salary: CZK 62 000 per month

Application deadline: 31 August 2023

Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #6-3

1 Topic name	Human Factors in Aviation: Vesibular Illusions Research
ERC research field descriptor	15.1 Aerospace engineering, 15.4 Biomedical engineering
2 Link to topic / project page	https://uld.fd.cvut.cz/index.php/en/science-and-research/projects-and-grants/postdoc_hf/
3 Short description of the topic	The primary goal of the project is to develop evidence-based methodologies and procedures that would allow the incorporation of vestibular illusion simulators into pilots' initial training, in the way which would allow acceptance of flight hours of pilots' training along with the benefit of practical spatial disorientation training. This concept focuses on the training period, where pilots learn to fly with instruments. The main output will be certified methodology enabling the implementation of such simulators into ab-initio pilot training. The objectives of the project will be achieved through research activities that should demonstrate the importance of implementing vestibular illusion training into pilot simulator training, which should contribute to increasing safety in air transport. Research activities will be based on monitoring and assessing the pilot's behavior when inducing the vestibular illusion and the effect of the illusion on their performance and psychophysiological condition. Performance will be evaluated based on the accuracy and correctness of piloting during defined flight tasks and psychophysiological condition through the organism's physiological response to a stressful situation. The concept designed in this way is intended to ensure the possibilities of adequate statistical evaluation and interpretation of results based on hypothesis testing methods.
4 Description of the ideal candidate	• Degree in Biomedical engineering, Aerospace Engineering, Statistics, Mathematics or other relevant field • Demonstrated knowledge of quantitative data collection and analysis techniques and research methodologies • General knowledge of qualitative data collection, protocol development, and facilitation skills and interest in contributing to qualitative research activities • Ability to produce written reports in a variety of formats for easy interpretation and use, and to design and prepare graphs, tables, and other visuals. • Ability to identify findings from research and data, evaluate alternatives, and draw conclusions relating to policy or practice • Demonstrated computer skills to perform data analysis using at least one of the following statistical software packages: SAS, R, Matlab (preferred). • Advanced programming skills – Matlab or Python preferred. • Experience with biological signal processing. • Organizational skills to plan and prioritize work efficiently and productively to meet competing deadlines

Mentor

Vladimir Socha	Faculty of Transportation Sciences	Department of Air Transport	sochavla@fd.cvut.cz

Salary: CZK 62 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #6-4

1 Topic	Digital Twin of Sustainable and Resilient Urban Area
2 Link to topic / project page	https://gatetoeurope.eu/
3 Short description of topic	Management of Smart Resilient City can use a variety of sensors, starting with physical detectors, cameras, and ending with space imaging (weather prediction, city temperature maps, and emission maps). It should be noted that even a vehicle or a mobile phone in this concept becomes an intelligent sensor providing important data. City management, thanks to current data, moves from the original predefined dynamic plans to adaptive control algorithms that ensure the coordination of entire territorial units. Different simulation tools are used to validate individual strategies. In virtual space, it is much easier to model responses to different types of extraordinary events. Verified strategies can then be projected into real-estate management through actuators, which may be both physical infrastructure facilities and navigation or assistance services, and prospective operation of autonomous systems such as unmanned vehicles.
4 Description of ideal candidate	The candidate should have advanced knowledge of cybernetics and artificial intelligence, the principles of cyber-physical systems, data interface programming and the creation of simulation and modeling tools, including the use of virtual and augmented reality.

Mentor

Miroslav Svítek	Faculty of Transportation Sciences	Department of Transport Telematics	svitek@fd.cvut.cz

Salary: CZK 62 000 per month
Application deadline: 30 November 2023
Start date: 01 January 2024

CTU Global Postdoc Fellowship

Topics/positions available at the

Faculty of Biomedical Engineering

Applications should be sent to E-mail:

Research topic #7-1 jan.vrba@fbmi.cvut.cz

Research topic #7-2 roubik@fbmi.cvut.cz

Research topic #7-3 kutilek@fbmi.cvut.cz

Research topic #7-4 vladimira.petrakova@fbmi.cvut.cz

CTU Global Postdoc Fellowship

Research topic #7-1

1 Topic	Applications of EM fields in medical diagnostics and therapy
2 Link to topic / project page	https://bioem.fbmi.cvut.cz/doku.php/en/start
3 Short descriptions of topic	Our research team is primarily involved in the design of methods and instrumentation for medical therapy and diagnostics based on the interaction of electromagnetic fields with biological tissues. The main therapeutic application that this team is dedicated to is the so-called microwave hyperthermia, which is successfully used to treat cancer. The main diagnostic applications include microwave non-invasive temperature monitoring during thermotherapy, blood glucose monitoring, and detection and classification of strokes. The candidate will be involved in one of the above areas in the design of reconstruction algorithms, antenna elements, imaging or hyperthermic systems, treatment planning algorithms, amplifier design, permittivity measurement, etc.
4 Description of ideal candidate	The candidate should have a solid knowledge in electromagnetic field theory and experience with numerical simulation tolls. The candidate is going to be heavily involved in the preparation of journal manuscripts. Terefore, we expect the candidate to co-author at least three manuscripts accepted for publication in a journal indexed in the Web of Science or Scopus.

Mentor

Jan Vrba, Prof., Dr.-Ing.	Faculty of Biomedical Engineering	Dept. of Biomedical Technologies	jan.vrba@fbmi.cvut.cz

Salary: CZK 61 700 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #7-2

1 Topic	Respiratory technology, research and intensive care
2 Link to topic / project page	https://ventilation.fbmi.cvut.cz/
3 Short description of topic	Our research group is interested in all aspects of mechanical ventilation including theoretical analyses, modeling, design of respiratory care equipment, animal experiments, and clinical trials. Our research also covers topics from related areas of critical and intensive care medicine. The primary work will involve design and management of research experiments and experimental data processing and analysis. The successful candidate is also expected to write journal and conference papers and mentor students in research.
4 Description of ideal candidate	The candidate should have experience with biomedical signal or image processing and analysis, good software programming skills in Matlab, C, or similar. Background in one or more of the following areas: respiratory care, biomedical instrumentation, statistics, fluid mechanics, or control engineering. Skills in writing and publishing research papers indexed in Web of Science, excellent English communication skills.

Mentor

Karel Roubík, prof. Ing., Ph.D.	Fac. of Biomedical Engineering	Dep. of Biomedical Technology	roubik@fbmi.cvut.cz

Salary: CZK 61 700 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #7-3

1 Topic name	Analysis of physiological and movement data to improve health condition and work performance during the stay in analog missions and space
ERC research field descriptor	15.4 Biomedical engineering 167; 37.36 Space technology 436;
2 Link to topic / project page	https://starfos.tacr.cz/en/project/TL05000228
3 Short description of the topic	The research objective is to provide a tool for assessment of physiological and body movement data to improve health condition and work performance during a long-time stay in isolated, confined, and extreme (ICE) environment, i.e. analog missions and space. The tool will allow screening individuals and members of the teams in pre-selection, training and mission during a stay in ICE. The objective is to create a unique tool for evaluating the influence of physiological and movement data on the work performance and behavior of individuals in ICE. The tool is a reaction to the current need of society to train isolated individuals and teams performing work tasks during long missions.
4 Description of the ideal candidate	Knowledge of processing and analysis of biomedical data (ECG, EEG, etc.), processing of biomechanical data, image processing, statistical methods, basics of ergonomics. Programming languages: MatLab, Python.

Mentor

Patrik Kutilek	Faculty of Biomedical Engineering, Czech Technical University in Prague	Department of Health Care and Population Protection	kutilek@fbmi.cvut.cz

Salary: CZK 62 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #7-4

1 Topic name	Subdiffraction manipulation of light by plasmonic assemblies
ERC research field descriptor	87, 167, 180 357
2 Link to topic / project page	http://petrakova-group.eu/
3 Short description of the topic	The project aims to develop new tools for sub-diffraction manipulation of light using plasmonic nanoparticles. We use single molecule localization microscopy and other single molecule microscopy and spectroscopy techniques, DNA nanotechnology and machine learning to create and reconstruct plasmon-modulated images.
4 Description of the ideal candidate	The ideal candidate has earned their PhD in physics, or related fields with focus on plasmonics or electromagnetic field. Experience with the fabrication of plasmonic structures in the form of nanoparticle assemblies, using plasmonic structures for enhancement of optical signals, or theoretical modeling of plasmonic systems is welcome. We encourage theoreticians as well as experimentalists to apply. The project is very interdisciplinary and the candidate will have to cooperate with non-physicists, so excellent communication skills and curiosity about other fields are a big asset.

Mentor

Vladimíra Petráková	Faculty of Biomedical Engineering, Czech Technical University in Prague	Department of Health Care and Population Protection	vladimira.petrakova@fbmi.cvut.cz

Salary: CZK 62 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Topics/positions available at the

Faculty of Information Technology

Applications should be sent to

E-mail: research@fit.cvut.cz

CTU Global Postdoc Fellowship

Research topic #8-1

1 Topic name	Symbolic Virtual Machine
ERC research field descriptor	82,88
2 Link to topic / project page	github.com/cksystemsgroup/unicorn
3 Short description of the topic	We propose to design and implement a symbolic virtual machine for efficient and multicore-scalable symbolic execution and benchmarking of RISC-V machine code based on the Unicorn toolchain:
4 Description of the ideal candidate	For this purpose, we are seeking a postdoctoral scholar with a strong background in the intersection of programming languages, systems, architecture, and formal methods.

Mentor

prof. Christoph Kirsch	FIT ČVUT	18201	christoph.kirsch@fit.cvut.cz

Salary: CZK 65 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #8-2

1 Topic name	Algorithmic and combinatorial game theory
ERC research field descriptor	27.7 Discrete mathematics
2 Link to topic / project page	https://en.wikipedia.org/wiki/Algorithmic_game_theory https://en.wikipedia.org/wiki/Combinatorial_game_theory
3 Short description of the topic	The first topic of the project is the algorithmic game theory, which is a modern branch of classical game theory, focusing on algorithmic aspects of modelling the behaviour of participants (players) of certain competitive process (game). The motivation is the study of methods, how to control competitive environment with many players and without a central authority which may impose demands on players. It is possible to attain this goal by designing locally defined games, whose Nash equilibria correspond to globally desirable outcomes. This fact is captured by the low price of anarchy of the game. The goal of the project is to establish and publish new results in algorithmic game theory, mainly by designing games where the Nash equilibria correspond to globally desirable outcomes and by investigating their algorithmic and computational complexity aspects. The second topic deals with the broad range of combinatorial games, mainly in the subfield of the various cops-and-robber settings. Here the setting is usually defined as a game on graph between two players controlling two sets of pawns, where the typical goal of one player is to capture the pawns of the second player. There is however great variability on the rules. Here the task is to study the computational complexity of questions like who wins or how many pawns are neede to win. The project is theoretical, with the expected outcome in the form of publications in high-ranking conferences or prestigious journals.
4 Description of the ideal candidate	The applicants are expected to have a strong background in combinatorics, graph theory, foundations of algorithmic game theory or combinatorial game theory. Additionally, specialization in the following areas is a bonus: graph algorithms, cops-and-robber-type problems, computational complexity or approximation algorithms. The applicant must have obtained a PhD in the relevant area no later than 7 years ago.

Mentor

Dušan Knop	Faculty of Information Technology	Department of Theoretical Computer Science	dusan.knop@fit.cvut.cz

Salary: CZK 65 000 per month
Application deadline: 15 June 2023
Start date: 01 July 2023

CTU Global Postdoc Fellowship

Research topic #8-3

1 Topic name	Non-linear Functional Analysis
ERC research field descriptor	306
2 Link to topic / project page	
3 Short description of the topic	The successful candidate will contribute to research in the area of non-linear geometry of Banach spaces. This includes in particular the Banach space properties, structure and metric characterizations of Lipschitz-free spaces and their biduals, which are relevant to Lipschitz classes of Banach spaces, or problems related to the stability of the local and asymptotic structure of Banach spaces under non-linear isomorphisms or embeddings of various regularity.
4 Description of the ideal candidate	The ideal candidate should have an interest and basic knowledge in functional analysis and metric geometry that is relevant and complementary to the research topic of this position.

Mentor

Eva Pernecká	Faculty of Information Technology	Department of Applied Mathematics	perneeva@fit.cvut.cz

Salary: CZK 65 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #8-4

1 Topic name	Repetitions in morphic languages generated by a recognizable morphism
ERC research field descriptor	27.7 Discrete mathematics
2 Link to topic / project page	https://staroste.pages.fit/posts/2021-03-31-open-postdoc-position.html
3 Short description of the topic	Recognizable, or circular, morphisms are defined by the existence of a bound on length of factors they generate (in the terms of an D0L-system or HD0L-system) which, when attained, allows a unique preimage to be found. This bound is thus useful in many algorithm working with languages generated by a morphism, including the known algorithm to calculate the larges exponent that appears in such language for non-erasing morphisms. This research topic plans to entail on this problematic by analyzing the relation of existence of repetitions in such a language and recognizability/circularity of morphism with the goal of understanding maximal (critical) exponent in such a language and its infimum, possible over a some specific class of morphic languages, such as generated by uniform or bifix-free morphisms.
4 Description of the ideal candidate	The ideal candidate should have done his PhD in symbolic dynamic or combinatorics on words, with a possible overlap with general algebra. She/he should have been able to conduct computer experiments.

Mentor

Štěpán Starosta	Faculty of Information Technology	Department of Applied Mathematics	stepan.starosta@fit.cvut.cz

Salary: CZK 65 000 per month
Application deadline: 15 June 2023
Start date: 01 July 2023

CTU Global Postdoc Fellowship

Research topic #8-5

1 Topic name	Multi-agent Path Finding
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	http://mapf.info https://fit.cvut.cz/cs/veda-a-vyzkum/zazemi/laboratore/17236-laborator-robotickych-agentu-roboagelab
3 Short description of the topic	Multi-agent path finding (MAPF) is a problem of navigating multiple agents to their individual goal positions so that agents do not collide. The problem has been intensively studied recently from the perspective of heuristic search. However, there are still open questions especially in compilation-based approaches to MAPF and in how to reflect properties of real environments such a continuity of space and time in formal models of MAPF. Tests of novel concepts on real robots in a laboratory is an optional part of this research.
4 Description of the ideal candidate	The ideal candidate should actively publish in artificial intelligence venues (AAAI, IJCAI, ...) and/or in specialized venues focused on planning, heuristic search (ICAPS, AAMAS, SoCS, ...), or robotics (ICRA, IROS, ...) and in related journals (JAIR, AIJ). Strong programming skills preferably in C/C++ are required.

Mentor

Pavel Surynek	Faculty of Information Technology	Department of Applied Mathematics	pavel.surynek@fit.cvut.cz

Salary: CZK 65 000 per month
Application deadline: 30 November 2023
Start date: 01 January 2024

CTU Global Postdoc Fellowship

Topics/positions available at the

Klokner Institute

Applications should be sent to

E-mail: miroslav.sykora@cvut.cz

CTU Global Postdoc Fellowship

Research topic #9-1

1 Topic	Reliability and risk assessment of civil engineering structures considering sustainability principles
2 Link to topic / project page	https://www.klok.cvut.cz/en/about-the-institute/departments-of-the-institute/department-of-structural-reliability/
3 Short description of topic	Current methods used to design and assess civil engineering structures lead to their unbalanced reliability and often conservative approaches compromise the principles of sustainability in construction. This is why it is important to systematically develop the methods of probabilistic reliability assessment and optimisation that make it possible to adequately describe uncertainties in structural resistance and load effects. Adequate treatment of uncertainty is particularly important when assessing reliability of structures from novel materials such as ultra-high-performance concrete or 3D-printed materials. Further, societally acceptable risk criteria need to be updated to account for the sustainability principles.
4 Description of ideal candidate	A researcher experienced in the field of reliability and risk assessment of civil engineering structures (e.g. applications of the partial factor method; probabilistic modelling of material and geometrical properties, load effects, model uncertainties, system behaviour). Having good knowledge of English, communicative. Keen to be involved in both fundamental and applied research projects, willing to disseminate results through scientific publications and participation at conferences. A candidate's experience should match with one or more research topics developed in the Klokner Institute and mainly in the Department of Structural Reliability – see https://www.klok.cvut.cz/en/about-the-institute/departments-of-the-institute/department-of-structural-reliability/

Mentor

Miroslav Sýkora	Klokner Institute	Structural Reliability	miroslav.sykora@cvut.cz

Salary: CZK 70 000 per month
Application deadline: 15 June 2023
Start date: 01 July 2023

CTU Global Postdoc Fellowship

Topics/positions available at the

Masaryk Institute of Advanced Studies

Applications should be sent to

E-mail: david.vanecek@cvut.cz

CTU Global Postdoc Fellowship

Research topic #10-1

1 Topic	Role of ICT in education with special attention to virtual reality and augmented reality
2 Link to topic / project page	Communicate directly to mentor
3 Short description of topic	The main objective is to conduct innovative research in the field of teaching methodologies and the role of ICT in education with special attention to virtual reality and augmented reality. Proposed research topic will be derived from the area of eye tracking methods, various types of sensors, audiovisual data, etc. Technical assistance (measuring technologies and applications of virtual and augmented reality) to be offered by the ŠKODA AUTO a.s. and MIAS. The use of qualitative and quantitative analysis, statistical software tools such as SPSS is expected and appreciated. This position is located at the Czech Technical University in Prague.
4 Description of ideal candidate	He/She should be PhD graduate or equivalent degree from a study program focused on Education Sciences, Teaching Methodology, Pedagogy, Technical Teacher Training etc. oriented on technical education. Relevant publications are requiered.

Mentor

Doc. Ing. David Vaněček, Ph.D.	MÚVS ČVUT/ MIAS CTU	Institute of pedagogical studies	david.vanecek@cvut.cz

Salary: CZK 65 000 per month
Application deadline: 30 November 2023
Start date: 01 January 2024

CTU Global Postdoc Fellowship

Research topic #10-2

1 Topic	Didactic competencies of technical teachers at technial secondary schools and universities
2 Link to topic / project page	Communicate directly to mentor
3 Short description of topic	Deep knowledge of didactics and androdidacts and skills connected with teaching process represent the key competences of any teacher of technical subjects to perform effectivey in his/her activities. The teacher manages relations of individual items of the didactic system, is able to select appropriate didactic devices based on the specific character of a technical course (subject), respects psychological specifications of students (psychostructure) and social climate of the educational institution. Research activities of potential post-doc at MIAS should be aimed at analyzing level of didactic competencies of technical teachers and their impact on student motivational risks in learning technical subjects.
4 Description of ideal candidate	He/She should be PhD graduate or equivalent degree from a study program focused on Education Sciences, Teaching Methodology, Pedagogy, Technical Teacher Training etc. oriented on technical education. Relevant publications are required.

Mentor

Doc. Ing. David Vaněček, Ph.D.	MÚVS ČVUT/ MIAS CTU	Institute of pedagogical studies	david.vanecek@cvut.cz

Salary: CZK 65 000 per month
Application deadline: 30 November 2023
Start date: 01 January 2024

Topics/positions available at the

Institute of Experimental and Applied Physics

Applications should be sent to:

E-mail: martina.vanisova@utef.cvut.cz

with a copy to robert.filgas@utef.cvut.cz for the research topics #11-1 and #11-2
with a copy to benedikt.bergmann@utef.cvut.cz for the research topics #11-3 and #11-4

CTU Global Postdoc Fellowship

Research topic #11-1

1 Topic name	3D modelling and technical documentation of space detectors
ERC research field descriptor	15.1 - Aerospace engineering 15.11 - Electrical engineering
2 Link to topic / project page	The predecessor R&D: https://artes.esa.int/projects/miram The target space missions: • https://blogs.esa.int/exploration/artemis-introducing-ersa-european-experiment-to-monitor-radiation-in-deep-space/ • https://www.wgtn.ac.nz/robinson/about/news/partnership-to-launch-ground-breaking-superconducting-magnet-in-space • https://www.ralspace.stfc.ac.uk/Pages/SWIMMR.aspx
3 Short description of the topic	IEAP CTU is developing and operating Timepix-based radiation monitors in space for over 10 years. Currently we are developing new generation of the radiation monitor called HardPix, which is planned for missions onboard ISS, Lunar Gateway and satellites in Earth orbit. Our team of engineers would welcome help with the creation of technical documentation, 3D modelling of the devices, preparation of the materials for production and completion of equipment.
4 Description of the ideal candidate	Ideal candidate engineer should master 3D modelling (Fusion 360, Inventor or SolidWorks), be precise and be able to get things done. Experience with simulations (temperature and mechanical stress) and electrical engineering is an advantage.

Mentor

Robert Filgas, Ph.D.	Institute of Experimental and Applied Physics (IEAP CTU)	Department of experimental physics	robert.filgas@utef.cvut.cz

Salary: CZK 60 000 per month
Application deadline: 15 June 2023
Start date: 01 September 2023

CTU Global Postdoc Fellowship

Research topic #11-2

1 Topic name	Onboard processing for space detectors
ERC research field descriptor	15.1 - Aerospace engineering 15.11 - Electrical engineering
2 Link to topic / project page	The predecessor R&D: https://artes.esa.int/projects/miram The target space missions: • https://blogs.esa.int/exploration/artemis-introducing-ersa-european-experiment-to-monitor-radiation-in-deep-space/ • https://www.wgtn.ac.nz/robinson/about/news/partnership-to-launch-ground-breaking-superconducting-magnet-in-space • https://www.ralspace.stfc.ac.uk/Pages/SWIMMR.aspx
3 Short description of the topic	IEAP CTU is developing and operating Timepix-based radiation monitors in space for over 10 years. Currently we are developing new generation of the radiation monitor called HardPix, which is planned for missions onboard ISS, Lunar Gateway and satellites in Earth orbit. Our team of engineers would welcome help with the development of firmware for space detectors, implementation control and data processing algorithm in MCU.
4 Description of the ideal candidate	Ideal candidate should master C/C++ language and embedded FW development, testing and debugging on resource limited platforms (MCU). A great advantage is knowledge of RTOS (FreeRTOS), experience with MCU (STM32, MSP430), industrial communication software protocols like UART, I2C, SPI, Python scripting, SW development process including build environment and versioning systems (Git), experience with FPGA or experience with PCB design.

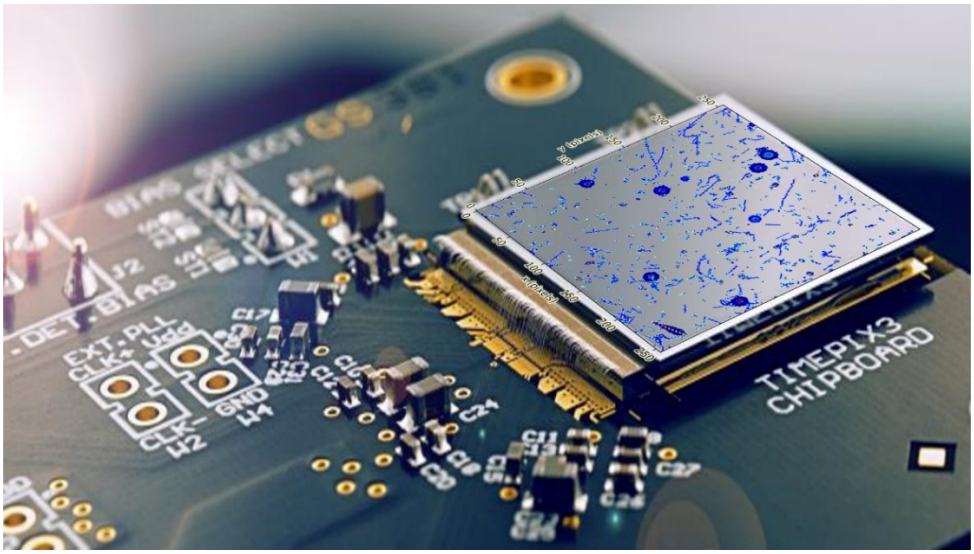
Mentor

Robert Filgas, Ph.D.	Institute of Experimental and Applied Physics (IEAP CTU)	Department of experimental physics	robert.filgas@utef.cvut.cz

Salary: CZK 70 000 per month
Application deadline: 15 June 2023
Start date: 01 September 2023

CTU Global Postdoc Fellowship

Research topic #11-3

1 Topic name	Development of innovative read-out systems for advanced pixel detectors
ERC research field descriptor	15.11 - Electrical engineering 37.22 Measurement technology 422
2 Link to topic / project page	Project description https://cernbox.cern.ch/s/FPpnxC1BlPNtyNC
3 Short description of the topic	Fundamental science applications, such as high-energy physics and space research depend on fast and reliable detector systems to identify particles and determine their energy. Hybrid pixel detectors (HPD) enabling single-particle processing are ideal since they are noiseless and can determine the time and energy of the particle interaction with high precision. A bottleneck in many applications is the high data rate and correspondingly huge data sets. Introduction of artificial intelligence-based data compression and analysis concepts both close to the detector and for off-line analysis is a key for the future.  *Photograph of a Timepix3 hybrid pixel detector and illustration of the detected particle signatures. The applicant will work on innovative read-out systems allowing or data processing on FPGA level.* HPDs are composed of a sensor, which can be any highly resistive semi-conductor, and the readout electronics (referred to as ASIC). Analogous to silicon drift detectors, HPDs directly utilize electron-hole pairs created by the interaction of an ionizing particle in the sensor for creation of a measurable electronic signal. The linear correlation between dissipated energy and signal height allows to extract energy information. In contrast to silicon drift detectors, the HPDs are segmented into small pixel cells, therefore providing additional spatial information. In comparison with scintillating detectors, a much finer sensor segmentation and a much better energy resolution can be achieved. In particle physics experiments, HPDs are an integral part of the tracking systems closest to the interaction points owing to their good spatial resolution and radiation tolerance. In this project, HPDs developed in the Medipix collaborationsat CERN https://medipix.web.cern.ch/ – namely Timepix4 – will be the foundation of designing innovative detection systems for application in a number of fields, e.g, nuclear medicine (diagnostics), radiation dosimetry, neutron and X-ray imaging, non-destructive testing, nuclear safety, and space research. We will hereby focus on the key strength of these detectors to visualize otherwise invisible radiation by imprints in the pixel screen with a rich set of features, which can them be exploited for the identification of impinging particles ro for particle trajectory or reaction kinematics reconstruction.

	Within the project, • You will work on the design of readout electronics for hybrid pixel detectors of Timepix4 technology and optimization for different experiments in physics or single-particle imaging modes. • You will study the applicability of the devices for space application proposing methods for on-board processing and evaluate different power saving modes. • You will perform measurements at various radiation facilities all over the world. • You will face and cope with challenges such as large data rates, which might require innovative methods for data compression on the FPGA or microcontroller level, and achiving pico-second scale time resolution. Your achievement shall be presented on international conferences, at Medipix meetings and published in well-recognized international journal. You will work in the department of "Electronics and Software" of IEAP CTU, which is a leading group in the development of pixel detector readout systems, related detector control software and novel analysis methodology. The latest activities are here or in a compact form here. Working in close contact with experts within the Medipix collaboration and profiting from the well-established international network of IEAP CTU, you will be able to significantly increase your scientific network, while alos profiting from IEAP CTU's close contacts to industry. References [1] X. Llopart et al 2022 JINST **17** C01044 [2] P. Burian et al 2017 JINST **12** C11001 [3] P. Burian et al 2020 JINST **15** C01037 [4] Bergmann, B., Pichotka, M., Pospisil, S. et al. 3D track reconstruction capability of a silicon hybrid active pixel detector. Eur. Phys. J. C **77**, 421 (2017).
4 Description of the ideal candidate	Ph.D. in electrotechnics, strong background in area of readout system, FPGA and microprocessor control. Interested in working in a multidisciplinary and international team requiring good communication skills.

Mentor

Dr. Benedikt Bergmann	Institute of Experimental and Applied Physics (IEAP CTU)	Department of electronics and software	benedikt.bergmann@utef.cvut.cz

Salary: CZK 70 000 per month
Application deadline: 15 June 2023
Start date: 01 September 2023

CTU Global Postdoc Fellowship

Research topic #11-4

1 Topic name	ATLAS-Timepix3: A detector network for measurement of luminosity and the radiation fields in the ATLAS cavern - Data analysis coordinator
ERC research field descriptor	365 Physics (high energy physics, particle physics) Data analysis 37.22 Measurement technology 422
2 Link to topic / project page	• ATLAS-Timepix3 https://cernbox.cern.ch/pdf-viewer/eos/user/b/bbergman/atlas-tpx3_upgrade_latest.pdf?contextRouteName=files-spaces-generic&contextRouteParams.driveAliasAndItem=eos/user/b/bbergman • Related project "Particle identification in high energy physics experiments and space with advanced detection systems" https://cernbox.cern.ch/s/FPpnxC1BlPNtyNC
3 Short description of the topic	A network of ~13 two-layer Timepix3 pixel detectors have been installed in ATLAS with the aim of **measuring luminosity** and providing information about the **radiation field composition** at different locations in the ATLAS cavern. Timepix3 is a cutting-edge hybrid pixel detector with 256 x 256 pixels each of area 55 x 55 μm^2. The pixelated sensor is coupled to the readout ASIC, which provides the information of the time-of-arrival (particle interaction time, precision ~2 ns) and the time-over-threshold (energy) in each pixel. Ionizing radiation interacting in the sensor is then seen as imprints in the pixel matrix with characteristic shapes depending on the particle of interest. With the two-layer approach, we further facilitate the separation of charged and neutral particles and improve impact angle determination. The time resolution of the devices and synchronization with the LHC orbit clock allows to resolve the bunch structure of the LCH beams, so that we expect to be able to measure the luminosity bunch-by-bunch, for the first time with hybrid pixel detectors. The capability to separate different particle classes shall be exploited to reduce the systematic errors of the luminosity measurement. Comparison of measured particle fluences and ATLAS simulations will be used to assign safety factors for radiation dose estimation and improve the understanding of radiation tolerance needed for detectors at the HL-LHC. Within the project, • you will be responsible for the analysis of data taken with ATLAS-Timepix3 and represent the team in the offline luminosity meetings and the radiation simulation group of the ATLAS experiment; • you will develop improved analysis methodology and define tasks for your coworkers; • you will be responsible for the preparation of publications and conference contributions. The position will help you to significantly improve your research profile by increasing leadership and mentoring skills. You will work in an international and interdisciplinary team with coworkers at different stages of the career. You will work in the department of "Electronics and Software" of IEAP CTU, which is a leading group in the development of pixel detector readout systems, related detector control software and novel analysis methodology. The latest activities are here or in a compact form here.

CTU Global Postdoc Fellowship

4 Description of the ideal candidate	You should have a Ph.D. in physics, are interested in data analysis and not scared of large data sets. Fluent English is required. Programming skills in C++, knowledge of ROOT, simulation in Geant4 and experience with leading a small team are not needed but an advantage. You will profit from knowing your way in large collaborations (ATLAS).

Mentor

Dr. Benedikt Bergmann	Institute of Experimental and Applied Physics (IEAP CTU)	Department of electronics and software	Benedikt.bergmann@utef.cvut.cz

Salary: CZK 65 000 per month
Application deadline: 15 June 2023
Start date: 01 September 2023

CTU Global Postdoc Fellowship

Topics/positions available at the

Czech Institute of Informatics, Robotics and Cybernetics

Applications should be sent to

E-mail: Katerina.Hanzalova@cvut.cz

or

CIIRC CVUT
Attn: Mgr. Kateřina Hanzalová
Jugoslávských partyzánů 1580/3
160 00 Praha 6
Czech Republic

CTU Global Postdoc Fellowship

Research topic #12-1

1 Topic	Machine learning security and resilience
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	https://www.ciirc.cvut.cz/teams-labs/ai/ml/
3 Short description of topic	Machine learning models play an increasingly important role in decision making across many applied domains such as robotics, health, or finance. It is therefore crucially important that they are sufficiently secure and resilient to adversarial or anomalous input. In this project, we aim to develop methods that improve the security and resilience of machine learning models, with emphasis on robotics applications, so improving the robustness of robo,ts especially in open environments.
4 Description of ideal candidate	Background in machine learning. Experience/interest in data analytics, robotics, and cybersecurity is welcome.

Mentor

Robert Babuška	CIIRC	Machine Learning	robert.babuska@cvut.cz

Salary: CZK 75 000 per month
Application deadline: 15 June 2023
Start date: 01 September 2023

CTU Global Postdoc Fellowship

Research topic #12-2

1 Topic	Machine Learning for Reasoning with Theories
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	https://ai.ciirc.cvut.cz/groups/FM/
3 Short description of topic	We will apply Machine Learning (ML) approaches in the context of Satisfiability Modulo Theories (SMT) to incorporate human-like skills into existing SMT solvers. This includes (I) synthesis of complex symbolic objects that represent solutions to non-trivial problems coming from practical applications, (II) identification of subgoals, and (III) construction of libraries of partial solutions (IV) construction of abstractions during solving (such as induction hypothesis). The methods will rely on training using large language models dedicated to formal languages combined with adversarial or reinforcement learning approaches.
4 Description of ideal candidate	Strong background in automated reasoning and machine/reinforcement learning. Interest in application thereof, such as smart contacts and SW verification.

Mentor

Mikoláš Janota	CIIRC	Intelligent Systems	Mikolas.Janota@cvut.cz

Salary: CZK 75 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #12-3

1 Topic	Learning to solve multiple-view geometry
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	http://aag.ciirc.cvut.cz/
3 Short description of topic	We aim at using machine learning to address long-standing problems in multiple view geometry that traditional techniques cannot solve. For instance, current methods for computing camera geometry from image matches can cope efficiently with only relatively simple problems in two-view geometry, and there is still no efficient solver even for three-view geometry. We plan to develop a new approach to solving hard problems in multiple-view geometry by using machine learning to tune techniques from numerical algebraic geometry to the data, thus making them tractable and efficient.
4 Description of ideal candidate	Background in Computer Vision and Machine Learning. Interest in combining classical geometry and computational algebra with machine learning.

Mentor

Tomas Pajdla	CIIRC	Applied Algebra and Geometry	pajdla@cvut.cz

Salary: CZK 75 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #12-4

1 Topic	**Precise Visual Localization and Navigation via Implicit Neural Scene Representations**
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	https://www.ciirc.cvut.cz/cs/teams-labs/rmp/aag/
3 Short description of topic	Visual localization and navigation algorithms are key capabilities for a wide range of applications, including autonomous robots such as self-driving cars and augmented / virtual reality systems. Typically, these algorithms rely on explicit and discrete scene representations, e.g., sparse Structure-from-Motion point clouds in the context of visual localization or voxel grids for navigation and path planning. Recently, implicit scene representations based on neural networks have been proposed that offer a continuous scene representation, with highly impressive results in terms of the accuracy of the represented 3D geometry. The objective of this post-doc project is to develop visual localization and navigation algorithms based on implicit neural scene representations. The goal is to exploit the potential of these representations, which promise highly accurate 3D scene geometry at a small memory footprint, to design highly precise localization and navigation approaches. Important scientific challenges of this project include handling changing conditions, e.g., moving furniture, and precise representations in large-scale scenes (where the camera can be 10-100 meters away from the scene).
4 Description of ideal candidate	Strong background in 3D computer vision, robotics, and / or deep learning. Publications at the top conferences/journals in those fields, e.g., CVPR, ICCV, ECCV, NeurIPS, ICML, IJCV, TPAMI, ICLR, IROS, ICRA, CoRL, RSS or RAL.

Mentor

Torsten Sattler	CIIRC	RMP	torsten.sattler@cvut.cz

Salary: CZK 75 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Research topic #12-5

1 Topic	**Learning visuomotor skills for robotic manipulation**
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	http://impact.ciirc.cvut.cz/
3 Short description of topic	Humans can solve everyday manipulation tasks remarkably efficiently and safely. With only a few interactions they learn to use tools without knowing a priori their exact physical properties or the properties of the environment to solve tasks such as hammering a nail, shoveling snow, raking leaves, or drilling holes into different materials. Currently, there is no artificial system with a similar level of visuomotor capabilities. The objective of this post-doc project is to develop machine learning models grounded in the physical and geometrical structure of the world to enable learning safe visuomotor skills for robotic manipulation in new unseen environments with only a minimal amount of supervision, for example, coming from observing people performing the same task.
4 Description of ideal candidate	We are looking for strongly motivated candidates with interest in computer vision, machine learning and robotics. Successful candidates will have a strong background in at least one of these fields, excellent programming skills and a proven track-record of publications at the top conferences/journals in those fields that include CVPR, ICCV, ECCV, NeurIPS, ICML, IJCV, TPAMI, JMLR, IROS, ICRA, CoRL, RSS or RAL.

Mentor

Josef Šivic	CIIRC	RMP	josef.sivic@cvut.cz

Salary: CZK 75 000 per month
Application deadline: 30 November 2023
Start date: 01 January 2024

CTU Global Postdoc Fellowship

Research topic #12-6

1 Topic	Combining Neural and Symbolic Methods in Theorem Proving
ERC research field descriptor	9.0 Computer science
2 Link to topic / project page	http://ai4reason.org
3 Short description of topic	We will combine neural and symbolic methods in theorem proving and reasoning tasks. This includes (i) targeted neural and reinforcement architectures for learning guidance of interactive and automated theorem provers, (ii) synthesizing arguments, conjectures, functions, tactics and solutions by deep reinforcement learning methods combined with theorem proving feedback, and (iii) deeper integration of symbolic and differentiable methods inside theorem provers.
4 Description of ideal candidate	Strong background in automated reasoning and machine/reinforcement learning.

Mentor

Josef Urban	CIIRC	Intelligent Systems	josef.urban@gmail.com

Salary: CZK 75 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

CTU Global Postdoc Fellowship

Topics/positions available at the

University Centre for Energy Efficient Buildings
CTU of Prague

Applications should be sent to:

Jan Seibert: jan.seibert@cvut.cz

Robert Wawerka: robert.wawerka@cvut.cz

CTU Global Postdoc Fellowship

Research topic #13-1

1 Topic name	Energy Flexibility and Control in Energy Communities
ERC research field descriptor	Control engineering
2 Link to topic / project page	https://glocalflex.eu, https://energy-cities.eu/project/ascend/
3 Short description of the topic	Research focuses on studying the usability of building energy systems (heating, hot water, cooling, ventilation, and on-site RES systems) in the smart grid and energy community context. The decentralization of the energy sector and the increasing involvement of intermittent renewables poses a new challenge to grid stability. Although individual buildings are tiny consumers in the overall energy system, aggregating multiple buildings under coordinated management can improve energy efficiency in terms of resiliency, prioritizing clean energy usage, and improving grid stability. Deploying demand-side management can help buildings optimize their consumption and improve the usage of the storage systems while bringing significant savings to the final consumers. However, as buildings are complex, this needs to be carefully investigated and introduced to not impact the indoor environment quality and other aspects.
4 Description of the ideal candidate	We are looking for a highly motivated and independent researcher in the field of modern, clean and sustainable energy with an emphasis on building energy systems and their smart control and operation. The position includes participation in research activities within ongoing national and international projects (especially Glocalflex or ASCEND), publishing high quality academic papers and presenting results at conferences. Proficiency in programming ideally (in Matlab or Python) and knowledge of specialized building simulation software (TRNSYS, Modelica, IDA-ICE, EnergyPlus, etc.) is an advantage. The suitable candidate has an active knowledge of the English language (written and verbal) and excellent presentation skills.

Mentor

MSc. Sofiane Kichou, Ph.D.	University Centre for Energy Efficient Buildings	Laboratory of Photovoltaic Systems and Energetics	sofiane.kichou@cvut.cz

Salary: CZK 62 000 per month
Application deadline: 31 August 2023
Start date: 01 October 2023

Applications and selection proces

To apply for the CTU Global Postdoc Fellowship you need the following documents in English:

- CV, including list of publications (max. 4 pages). At least three IF [1] journal publications are expected. Papers accepted for publication yet waiting to be prited **do count if** a proof of acceptance is provided.

- Motivation letter (max. 2 pages).
- PhD certificate (copy).
- Application for CTU Postdoc Fellowship Program – completed and signed.
- You may attach other documents supporting yor application such as recommendation letters etc.

The application must reach CTU by June 15, 2023 or August 31, 2023 or November 30, 2023. The deadline for submission is indicated for each research topic/position.

Please, note that applications should be sent to Faculties/Institutes as indicated in the list of Topics/Positions.

Selection process:

Applications will be assessed by a committee, based on documents sent by applicants. The mentor has a strong vote in the selection process.

An (online) interview preferably within the second half of June will be organized.

The start dat eis indicated for each research tipic position.

1 Impact Factor. We follow the Web of Science Journal Citation Reports .